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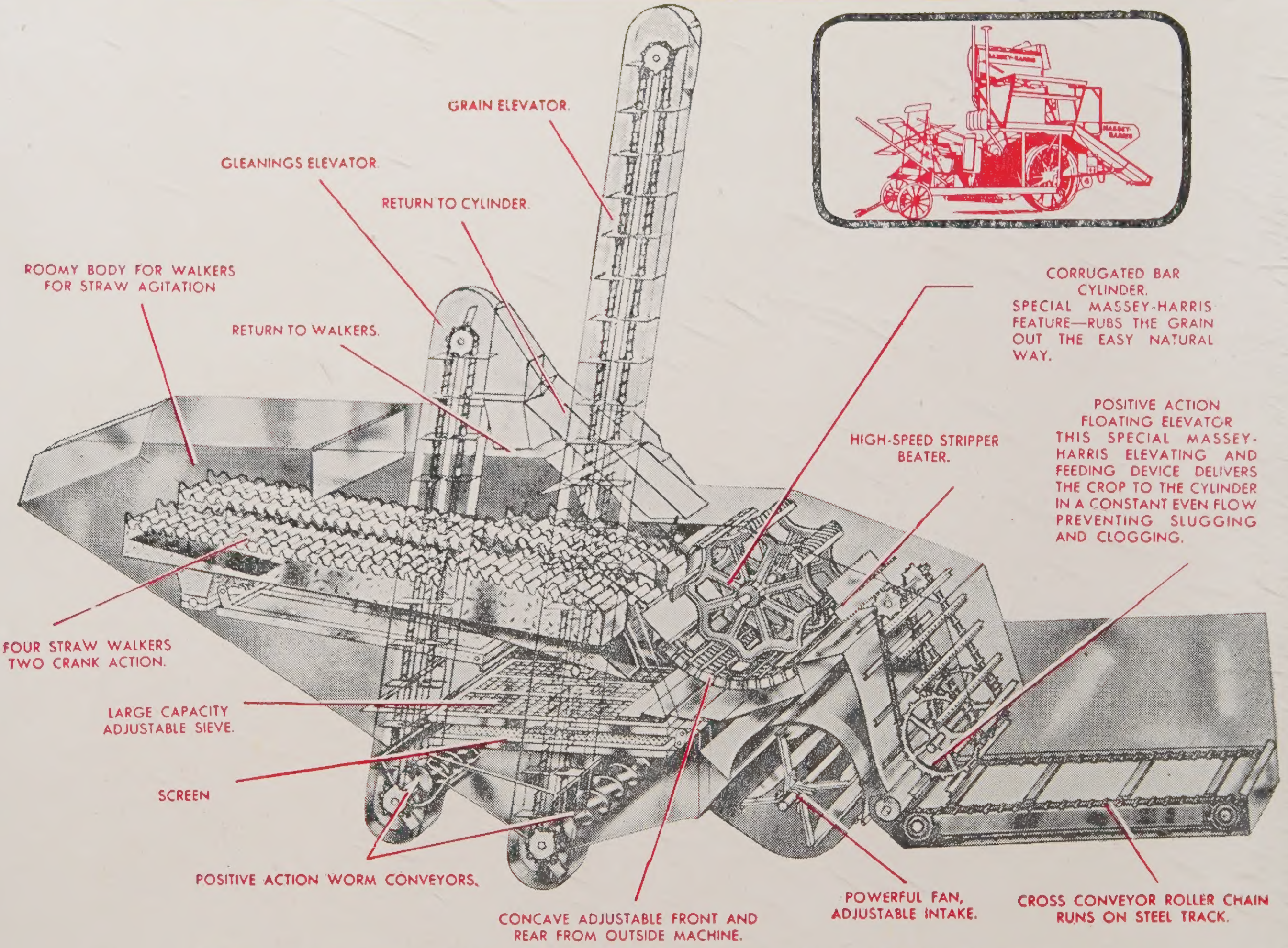
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New Zealand
JOURNAL of
AGRICULTURE

Care of Sheepskins from the Farm to the Store

By H. M. SIEVWRIGHT, *Instructor in Sheep Husbandry, Wellington.*

At least half of the skins of sheep killed by the farmer and the country butcher in New Zealand are classed as "dead" or "damaged," despite the fact that, when they are removed from the sheep, they are potential "abattoir" grade skins. To reduce this loss a little more time and a great deal more care must be spent in preparing sheepskins on farms. To the farmer who does not know how to prepare sheepskins correctly this article explains common faults and how to avoid them; to the farmer who does not care it shows that he is losing a large profit from an important product of the farm.

THE sheepskins bought by the Sheepskin Control each year are made up of the following classes:—

52 per cent.: abattoir quality.
16 per cent.: country skins.
18 per cent.: slightly-damaged skins.
14 per cent.: dead and badly-damaged skins.

Abattoir grades are from abattoirs, or are other properly-butchered skins of good shape, well taken off, free from excessive fat, and properly dried. They are invariably fresh and maintain their original bloom.

Country grades are mostly farmers' skins, sound, but neither as spready nor as good in shape as the abattoirs', and frequently semi-stale.

Damaged skins are those with slight defects, such as cuts, scores, off-shapes, and sweated butts or necks.

Dead and badly-damaged skins include those damaged by weevil, rat-eaten skins (but not badly enough to be classed as broken), and skins with excessive fat.

The 18 per cent. slightly-damaged skins, representing about 400,000 skins and 2,864,800lb., are for the most part skins which would have been sound but for avoidable damage caused by bad butchering, careless handling, or damage by pests. A considerable proportion of skins classed as dead and damaged would also be of greater value if they had been treated with more care.

There is no reason why a farmers' sheepskin, if properly taken off and correctly dried, should not be equal to the abattoir standard, and thus bring up to 5s. more. Apart from dead skins, which are estimated at about 5 per cent. of this classification, and, say, 5 per cent. for unavoidably-damaged skins, it should be possible to get "abattoir" grade for all skins.

Abattoir-quality skins are sold at a premium of about 1d. a pound above the country-grade prices in the price chart.

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...he can always learn something from the other fellow.

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Cost of Handling

The price for damaged skins reflects the fact that the cost of handling them is the same as for sound skins. In some cases the damaged skins give an inferior wool, usually because of poor colour and lack of lustre. The pelt from these skins is always of a secondary type, the proportion of rejects is much greater, and a poorer pickled pelt is produced. However, the labour and materials used in processing are not less than for sound skins. When the pickled pelt arrives at the tannery further labour and tanning material are required to produce a second-class basil or roan. The cost from the farm to the finished leather is much the same, whether the skins are in first-class condition or have been neglected.

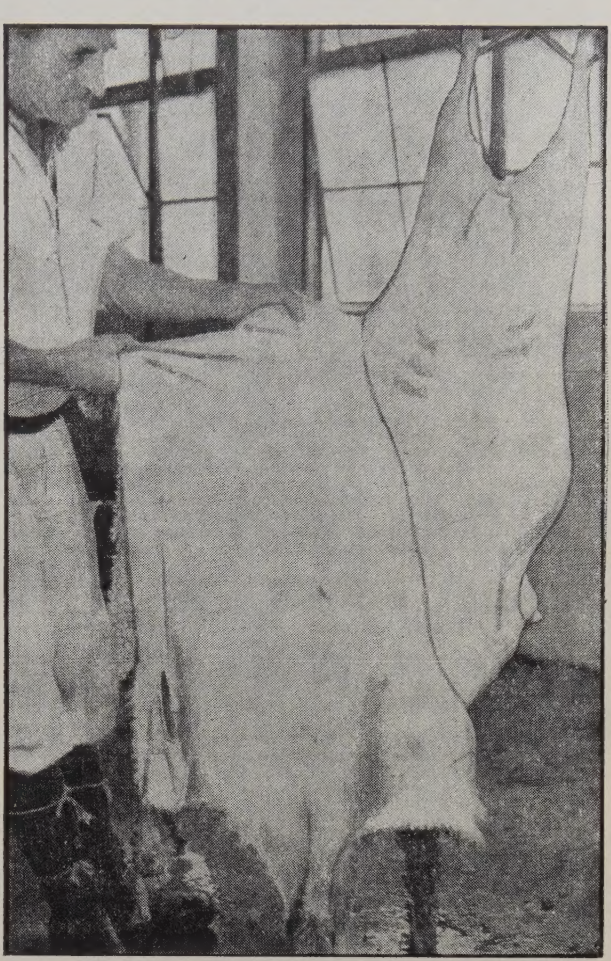
During the processing scores and cuts are frequently enlarged by the machines which treat them. The knives of a fleshing machine, for instance, when travelling across a cut skin will frequently tear the skin right across. The original neglect on the farm or in the slaughterhouse is multiplied several times before the finished article can be produced.

Skinning Precautions

Allow the sheep to stand for an hour or two before being killed; this avoids overheating, allows the paunch to be emptied, and prevents rapid heart action, which causes unsatisfactory bleeding. The sheep is best killed in shade on battens or on a concrete floor which can be sluiced down with fresh, clean water. Skin the body while it is still warm; the process is easier and a cleaner skin results. Make sure the sheep is well bled. When bleeding the sheep take care not to stain the wool or carcass with blood; any such staining which may occur should be washed off with a clean cloth and fresh water, which should always be kept on hand. Blood hastens the decomposition of the skin and causes the wool to deteriorate in appearance and value. The perished portion of a skin on sliping appears as a pattern of holes or dissolves completely.

After allowing the sheep to bleed thoroughly lay it on its back and run a sharp knife down the front of the foreleg to the point of the brisket and up the throat to beneath the chin. Next, run it down the back of the hind leg on the same side to the butt of the tail, followed by the other hind leg, and then the other foreleg, thus working in sequence round the sheep.

CARE OF SHEEPSKINS



A well-flayed skin is a potential top-grade skin.

Use the knife as little as possible. A blunt knife usually accounts for more cuts than a well-sharpened one, because more pressure is required. Punch, "thumb," and pull carefully where possible, using the wooden handle of the knife for punching at times. Care must be taken, especially when skinning lambs, not to punch and thumb so severely that the wool side, or grain, of the skin is ruptured. Avoid cutting in the body of the skin, as a single cut there reduces the value of the skin by one-third. Skin as squarely as possible, being careful to cut down the middle of the belly line.

PRICE CHART FROM A GOOD AVERAGE FARMERS' SELECTION

New Zealand Sheepskins Control 9th Schedule Prices at July 29, 1946

Type.	Average Weights of Skin Dried (lb.)	Country Skins, sound and free from faults.		Slightly-damaged skins, resulting from neglect by farmers.		Dead and badly-damaged skins, most of which could have been saved. Caused by neglect, sweating, heating, poor take-off, cuts, weather, weevils, or tearing.	
		Per lb.	Per skin.	Per lb.	Per skin.	Per. lb.	Per skin.
Half-bred full wools	10	13½d.	11s. 3d.	11½d.	9s. 8d.	9¾d.	8s. 1½d.
Half-bred ¾ wools	8	12¾d.	8s. 6d.	10¼d.	6s. 10d.	8½d.	5s. 8d.
Half-bred ½ wools	7	11¼d.	6s. 6¾d.	8½d.	4s. 11½d.	6¾d.	3s. 11½d.
Half-bred ¼ wools	5½	9¾d.	4s. 5⅝d.	7¼d.	3s. 3⅞d.	5½d.	2s. 6¼d.
Half-bred shearlings	4	8¼d.	2s. 9d.	4½d.	1s. 6d.	2½d.	10d.
Half-bred hoggets	7	12¾d.	7s. 5¼d.	10d.	5s. 10d.	8½d.	4s. 8d.
Half-bred lambs	5	13½d.	5s. 7½d.	10½d.	4s. 4½d.	9d.	3s. 9d.
Crossbred full wools	11	13¼d.	12s. 1¾d.	11¼d.	10s. 3¾d.	9d.	8s. 3d.
Crossbred ¾ wools	8½	12½d.	8s. 10¼d.	9¾d.	6s. 10⅞d.	8d.	5s. 8d.
Crossbred ½ wools	7½	11¼d.	7s. 0⅝d.	8½d.	5s. 3¾d.	6¾d.	4s. 2⅝d.
Crossbred ¼ wools	5½	9¾d.	4s. 5⅝d.	7¼d.	3s. 3⅞d.	5½d.	2s. 6¼d.
Crossbred shearlings	4½	8¼d.	3s. 1¼d.	4½d.	1s. 8¼d.	2½d.	11¼d.
Crossbred hoggets	7½	12¾d.	7s. 11⅝d.	9½d.	5s. 11¼d.	8d.	5s.
Crossbred lambs	5	13¼d.	5s. 6¼d.	10d.	4s. 2d.	8¼d.	3s. 5¼d.
Bare pelts	3	7d.	1s. 9d.	3d.	9d.	1½d.	4½d.

★

SHEEPSKINS
IN
STORE

★

Leave as little fat and flesh as possible on the skin, and remove what little remains while the skin is still green. If that is not done, the skin beneath sweats and does not dry readily or evenly, decomposition takes place, uneven tanning occurs, and the resulting basil is spoilt. Keep the skin free from foreign matter.

Expelling Body Heat

A good way of making sure that the body heat of a skin is expelled before it is stretched is by the process known as "potting." Place the freshly-removed skin wool upward on the floor of the woolshed, lift it by the wool in the middle of the back, and lower it gently to the battens. The skin is then in a heap through which air can circulate freely. This must be done before the skin is stretched or painted with anti-pest solution.

If a skin is dried in sunlight, skin side out, before the body heat is dissipated, it sheds its wool. In the trade a sheepskin with this fault is called a "puller." It becomes porous on being sliped and is graded unsound.

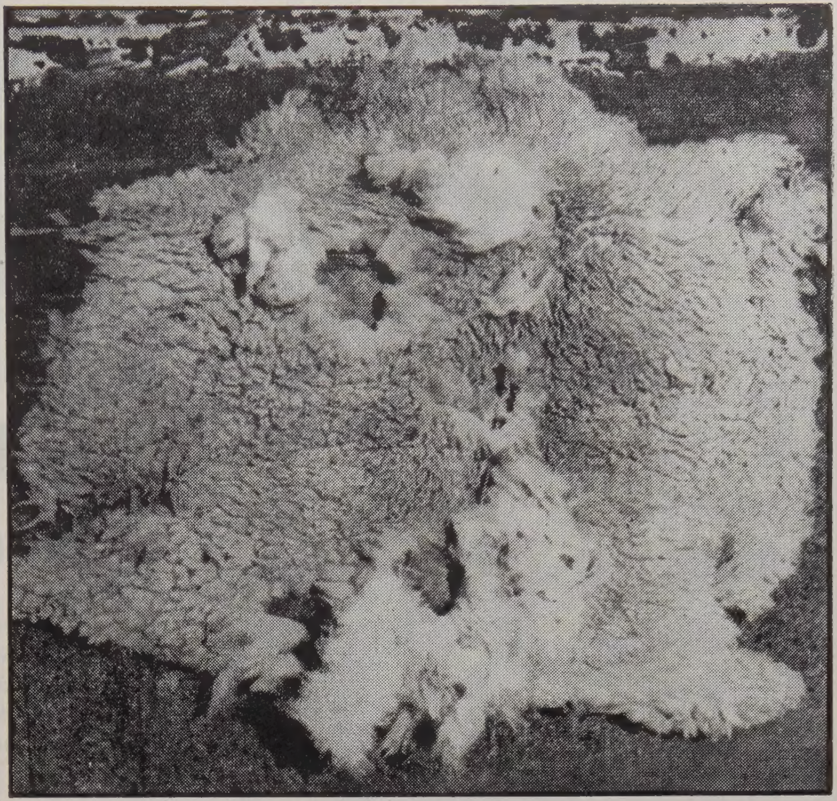
If a skin is stretched before the body heat is expelled and before a crust is formed, it may be distorted easily to any shape. A skin well prepared in every way except that it is wrongly stretched deteriorates in value.

Drying the Skins

It is best for the farmer to dry his sheepskins thoroughly in a woolshed, implement shed, or some covered space at sufficient height above the ground to avoid the risk of damage by dogs. Skins must not be hung on barbed-wire fences, dray wheels, fence posts, farm implements, or anything that puts the skin out of shape.

A simple yet efficient way to hang the skin after it has been potted is skin side out, with the neck and the butt squarely along two taut parallel wires kept 4in. apart by stapling them at intervals to small blocks of 4in. by 1in. board. If these wires tend to sag, it is easy to tighten them from the ends. The separate wires allow the free passage of air and do not compress the wool to the exclusion of air, as is the tendency when the skin is placed on rails or battens; this eliminates the possibility of sweating. The average woolshed is an ideal place for the drying of sheepskins.

To prevent the butt end from curling up and consequently sweating turn it under; or, better still, turn back just enough wool to prevent the skin from folding. Cut off the trotters. Clip off any dags or urine-stained wool. Keep turning down the edges of the neck, tail, and legs, and see that there is no overlapping until they have dried out.



Wool pulled from a sweated skin.

Leave the skin placed along the wire until it becomes crisp; it may then be placed neck and butt across the wires until the pelt (especially the edges, neck, and butt ends) is dry and firm. If the wool is damp, the skin may then be placed wool out until it has dried.

Skins must be dried under cover, because sunlight crusts the outer layer, preventing the inner moisture from escaping. The internal temperature rises and, as the inner layers contain a high proportion of fat, this, in effect, fries, raising a blister which, when the skin is tanned, forms an inferior basil. It is evident, therefore, that to prevent putrefaction the moisture must be removed from the skin, preferably by a current of dry air. Drying in direct sunlight is harmful. A woolly skin weighing 12lb. dries to about 8lb. under cover but to about 6¾lb. in sunslight.

A carefully-dried skin has no unpleasant smell. A skin dried too slowly becomes sloppy. Freezing or chilling of skins for the market is not practicable as in the meat trade, for in freezing the fibres of the undried skin are ruptured. Carefully-dried skins, carefully packed, can arrive at their destination in good condition.

Weights of dried skins are not standardised; for a sound crossbred pelt 3lb. to 3½lb. is allowed. The buyer of skins has to estimate what a skin will slipe in weight of clean scoured wool, and add the weight of pelt. Weighing damp skins, like weighing damp wool, is very unsatisfactory.

If insufficiently-dried skins are packed in with a bundle of carefully-dried skins, both the undried skins and others in contact with them will deteriorate because of sweating and a general increase in bacterial activity causing decomposition. For that reason it is bad practice to put green skins on the top of a bundle of dried skins.

Preventing Pest Damage

Thorough, fairly quick drying is all that is needed if care is exercised in the packing and disposal of sheepskins. If there is danger of rat or insect damage, the skins may be painted with an anti-pest solution. The average dip solution on the farm, **provided it is not of a carbolic (Phenolic) type,** is satisfactory. With a carbolic dip there is a tendency, if the dip is over strength, for the phenol to tan the outer layer of the skin on the living sheep, as well as on the painted skin. That can be noticed in a comparison

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of the pulling qualities of skins treated with carbolic and with non-carbolic dip solutions. The dip must be painted on as a dilute solution—not dry as is sometimes done. If the solution is too concentrated, the arsenic in it will burn the skin and spoil the grain of the leather.

Care must be used to ensure that the points, butt end, and neck are unrolled and thoroughly painted or all the gain from efficient skinning is wasted, because "sweating" will occur in the points and edges that have not been painted. That results in perished edges and points which have to be removed.

An arsenical solution painted on the skin has the desired effect of keeping down bacterial activity while the skin is drying, as well as keeping out weevils, silverfish, rats, moths, etc. A tin of dip solution and a brush should be kept in the woolshed for painting skins. Do not wait until the pests start their damage before painting.

Here are two reliable weevil preventive mixtures:—

1. 25lb. of arsenite of soda; ½lb. of bitter aloes; 25 gallons of water. Stir and boil. This forms the stock solution. Use 1 gallon of the solution to 2 gallons of water. As well as being bitter it is a deadly poison, so label the container.
2. 2 gallons of water; 1lb. of washing soda; 1 eggcupful of arsenite of soda. Dissolve the arsenic first in a small quantity of boiling water. Add the soda and the arsenic solution to the remaining water. Bottle and cork firmly, and label "poison."

Salt as a Preservative

Country butchers, who seldom have the necessary drying room under cover, may find salting the skins the best means of preserving them.

When taken from the carcass the skins should be potted out singly to allow the animal heat to dissipate. It is important not to leave the skins in this state longer than is necessary. Salting should be started as soon as the heat has gone. The skins should be trimmed (particularly neck pieces, which are heavy in blood) and opened out, flesh side up, preferably on a concrete floor. Each skin must be completely and evenly covered with fresh coarse salt.

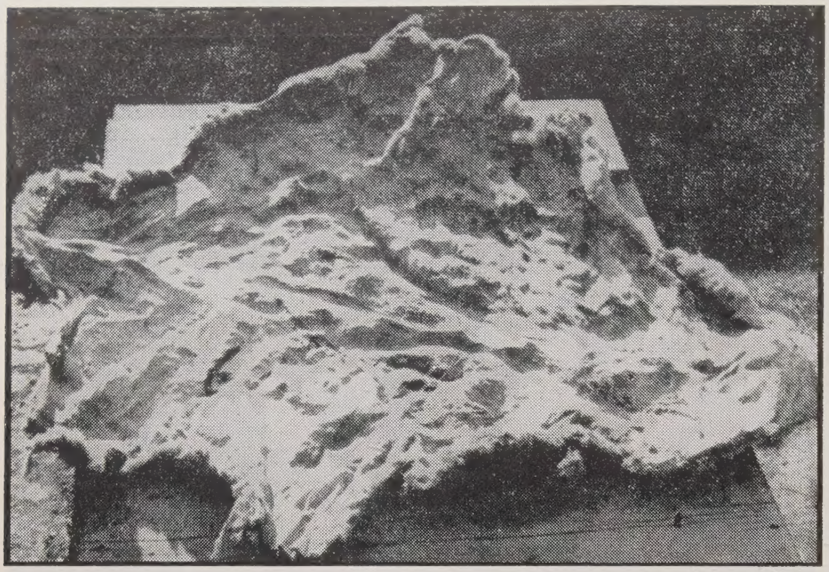
Working along one side of the space available, place the first skin at one end, pelt up, and spread the salt evenly over the whole surface. Place the next skin so that it overlaps the previous one by half, and then salt that. Continue this process backward and forward until the stack is about 2ft. 6in. high, when a fresh stack should be started. It is important to salt right out to the edges and not leave any extremities folded in. By this method of salting, space is saved and the brine is conserved in the stack.

A sheep took 5 years to grow this skin. Maggots destroyed it in a few days.

The amount of salt used should be not less than 2½lb. a skin for sheepskins and 2lb. for lambskins. The skins should be left in this stack for about a week to allow them to cure. Skins should be forwarded for marketing promptly and not kept longer than necessary.

Packing and Despatching

When the skins are thoroughly dry, carefully stack them away, preferably not in a corner but in the middle of the shed. Stacking in a corner makes a home for rats, mice, and weevils and prevents the free access of air. Skins should not be bundled pelt to pelt, as some time may elapse between bundling and transport to the store, though that delay should be avoided as much as possible. Dried skins must not be held in the shed for long periods, or even until the wool season, as is often done. Warmth and moisture



A skin which was overdried in direct sunlight.

may combine to renew bacterial activity, and bundles and loose skins are very subject to attacks from pests.

It is much more profitable to bundle a smaller number of skins often and send them to the broker than to let the dried skins accumulate. Bundle the skins squarely with no loose ends exposed, wool out, and tie them securely with rope or bale wire. Label the bundle clearly, and advise the broker when the skins have been consigned.

Avoidable Faults

Following are some of the major faults in handling the skins which result in their being graded down:—

Scored necks, done when opening round the neck with a knife, particularly in country butchers' skins.

Ruptured grain, especially in lambskins, caused by punching too fiercely when thumbing up.

Bad shapes, caused by hanging over posts, wool presses, cart wheels, and farm implements.

Faulty drying through hanging skins on fences without attention, the north side usually getting all the sun and most of the wind. The result is an overdry pelt on the north and a decomposed pelt on the south side.

Sweated edges, particularly butts and necks, caused through these parts not being properly opened up during drying.

Sweating on the body of the pelt, caused through the flesh side of the skin coming in contact with material such as a floor rail or implement, but particularly with another skin, during drying.

Sweated necks through blood-clotted wool not being opened up properly for drying.

Rat, mouse, and weevil holes through the skin being stored away too long before being marketed.

Common Trade Terms

Animal heat: Residual heat in a skin after its removal from an animal.

Basil: An undyed, vegetable-tanned pelt.

Broken skins: Very badly-damaged skins, usually badly torn, rat eaten, or weevil damaged. These are sweated to remove the wool.

Cockle: Small, hard lumps which are found on the grain side of some pelts after the removal of the wool and which remain as a fault in the finished leather. This fault is found mainly in pelts from long-woolled skins.

Points to Remember

Dry sheepskins under cover in a current of air.

Stretch them neck to butt along two taut parallel wires 4in. apart.

Keep folding out the edges.

Despatch them to the broker as quickly as possible—before the skins become stale.

Dead skins: Skins taken from animals which have died from natural causes. They are distinct from skins from sheep which have been butchered in that the blood has not been drained from the carcass. The wool will invariably pull from such skins and the pelts are of small value.

Depilatory: A preparation applied to the flesh side of sheepskins to free the wool; usually composed of lime and sodium sulphide.

Fellmongery: Works where wool is removed from sheepskins.

Flaying: Removal of skins from carcasses.

Flesh side: The surface of the pelt attached to the carcass before flaying.

Fleshing machine: A machine with rotating blunt knives, somewhat similar to those on a lawnmower, used in fellmongeries and tanneries. The flesh side of the pelt is brought into contact with these knives by a rubber roller so that flesh and fat are removed.

Grain side: The surface of the pelt previously covered with wool.

Glue pieces: Pieces of skin from which the wool has been separated by pieing. They are used by gluemakers.

Green skin: Fresh, moist sheepskin or lambskin.

Pickled pelts: Pelts, both sheep and lamb, which have had the wool removed and been treated and cured with salt and acid. They are usually casked and sold to tanners, local or overseas, in this form.

Potting out: Placing out skins (usually green) singly so that only the edges rest on the floor, the centre being raised like an inverted cup. This allows free circulation of air and will prevent heating and consequent damage for a short time.

Rejects: Pelts which are not considered worth working and are thrown out at some stage of fellmongering.

Roan: A finished sheepskin leather. The pelt is usually treated to give a moroccan or other grain.

Skin pieces: Neck and shank pieces cut from sheepskins or lambskins in trimming. Only the wool is of value, and it is removed by sweating or pieing.

Slipe wool: The wool pulled from the skin after treatment in the fellmongery. It is dried and baled ready for sale.

Thumbing up: The process of easing skin from the carcass by using the thumb. Used by butchers when taking the skin from sides and back.

Acknowledgments

Thanks are expressed to the New Zealand Sheepskin Control and to sheepskin brokers in both islands for data and co-operation.

THE RED-LEGGED EARTH MITE

Measures for Control of Pest and Protection of Vegetables

By L. J. DUMBLETON, *Entomology Division, Department of Scientific and Industrial Research.*

THE red-legged earth mite (*Halotydeus destructor* Tucker), first observed in New Zealand in 1942, has been known as a pest of vegetables for 40 years in the Cape Province of South Africa, has been in Western Australia for 30 years, and is now known as a vegetable pest in all the southern States of Australia. It is also a pest of subterranean clover pasture, more particularly in Western Australia. The habits and control of the mite have been carefully studied in Australia for many years, and much of the information in this article is from Australian sources.

THE mite first received attention in New Zealand in 1943, when specimens were sent in from West Shore, Napier, by Mr. D. Cunnold, who had observed their depredations on vegetables in 1942. It is likely that the mite was present for several years before that. There is no evidence of the method by which it gained entry into the Napier area.

The distribution of the mite was surveyed in 1945 and a closer survey was made in 1946. It is now known to exist over a wide area extending from Bay View to the eastern bank of the Ngaruroro River at its mouth near Clive. That includes the whole of the reclaimed Ahuriri Lagoon area down to the Napier Park racecourse and Kennedy Road, as well as several points round Bluff Hill and an area extending 4 miles up the Tutaekuri River. It has also been found in a smaller area at Matawhero (near Gisborne) and in Wairoa.

The occurrence of the mite at Gisborne and Wairoa in addition to the already large area at Napier makes it unlikely that complete eradication can be achieved, as the mite probably occurs, as yet undetected, in other localities. As the mite cannot fly, its spread under its own locomotion is probably slow, but it may be accidentally transported with soil or on flowing water.

Description of Mite

The adult mite (Fig. 1B) is a small organism with a body about 1-25in. long. The body colour is a matt black with a rather velvety appearance. It has four pairs of legs, commonly described as red but in reality salmon pink. The mites are easily visible to the naked eye on the ground or on a plant. They tend to be gregarious and cluster together when feeding. Their movements are very active.

The eggs are minute, barely visible to the naked eye, and yellowish or orange. The young mite which hatches from the egg is very small and has only three pairs of legs, but after the first moult the young mite is like the adult except in size.

The mites may be seen on the plants in the evening or early morning, or throughout the day on dull days or in sheltered situations. When present in large numbers they can easily be seen by lifting or parting the ground cover.

The Blue Oat Mite

There is another very similar mite with black body and brighter red legs which is present throughout New Zealand—the blue oat mite (*Penthaleus major* Dugés). It can be distinguished from *H. destructor* by a reddish streak in the middle of the back toward the tail (Fig. 1A). This streak is sometimes visible to the naked eye, but more often requires magnification. This mite is slower in movement than the red-legged earth mite and seldom occurs in large numbers, though it is recorded as damaging oat crops on the east coast of the South Island.

Reports of red-legged earth mites in new areas should not be accepted until specimens have been identified.

Life History

The red-legged earth mite appears to thrive best in Australia in areas with a dry summer and a winter rainfall. It is also said to do best on light-textured, sandy soils, but it is by no means confined to such soils.

In an area with low rainfall and high soil temperatures in summer the mite is present only in the egg stage during summer. The active stages of the mite die off with the approach of hot, dry conditions in spring or early summer, which in most years in the Napier area is probably in late November unless the mites are sheltered by a heavy growth of crop or pasture. The eggs hatch in the autumn —probably late March in most years— when the autumn rains begin and temperatures are lower. They will not hatch during the high temperatures of midsummer even if heavy rains occur.

The mites which hatch from the eggs in autumn mature and lay their eggs in about 60 days. These eggs give rise to a second generation which lays its eggs after a similar period. The mites hatching from this last lot of eggs mature but do not lay their eggs. With the approach of hot, dry weather the eggs are accumulated inside the body and remain there after the death of the parent mite; in that manner they pass the summer on or in the soil.

Each mite may lay 50 to 100 eggs, and those produced by the first two

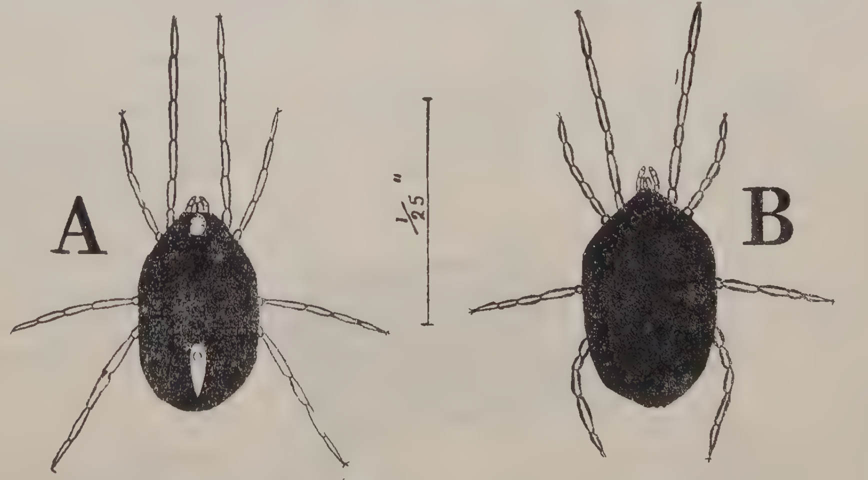


Fig. 1—Adult mites of the two species: A, *Penthaleus major*, the blue oat mite; B, *Halotydeus destructor*, the red-legged earth mite. The white areas in the illustration are reddish in the living mites.

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broods of mites are laid on the undersides of leaves and hatch in 1 to 2 weeks, depending on the temperature. The largest numbers of the mite tend to occur in spring, during September and October.

Symptoms of Damage

The mites live on a liquid diet which they obtain by piercing the leaves or stems of soft, succulent plants and sucking the sap or cell contents. The feeding places of the mite on a green leaf are marked by a white spot caused by the death of the damaged plant cells. When a heavy infestation is present the whole leaf may be blotched with white patches (Fig. 2) or completely silvered. Such leaves on soft plants will wilt and die. On soft young transplants and germinating seedlings severe damage will cause the permanent wilting and death of the plant.

Much of the damage to subterranean clover in Western Australia is done to germinating seedlings in autumn, especially if the initial autumn rains are followed by dry weather. Young shoots coming through the ground are retarded, stunted, or even killed by heavy mite attack.

Wide Range of Appetite

The mite attacks a very wide range of plants, including both weeds and cultivated plants. Many weeds, such as Scotch thistle, wild turnip, and stagweed, seem to be preferred as food plants. Of the cultivated plants, damage seems to be confined to the herbaceous, succulent, broad-leafed plants; little damage is done to grasses and cereals, and apparently none to woody plants. Many plants in the flower garden are attacked.

Among the vegetables, tomatoes, French beans, broad beans, peas, potatoes, asparagus, silver beet, and marrows have been damaged in New Zealand. Melons, turnips, tobacco plants, and lettuce are also reported to be damaged in Australia.

Many pasture legumes, such as burr clover, subterranean clover, *Melilotus*, and lucerne, are attacked and the white mottling on the leaves is quite evident in spring. Leaf damage to established plants, particularly perennials, in spring would seem unlikely to affect the carrying capacity or the vigour and reseeding of the plants very seriously.

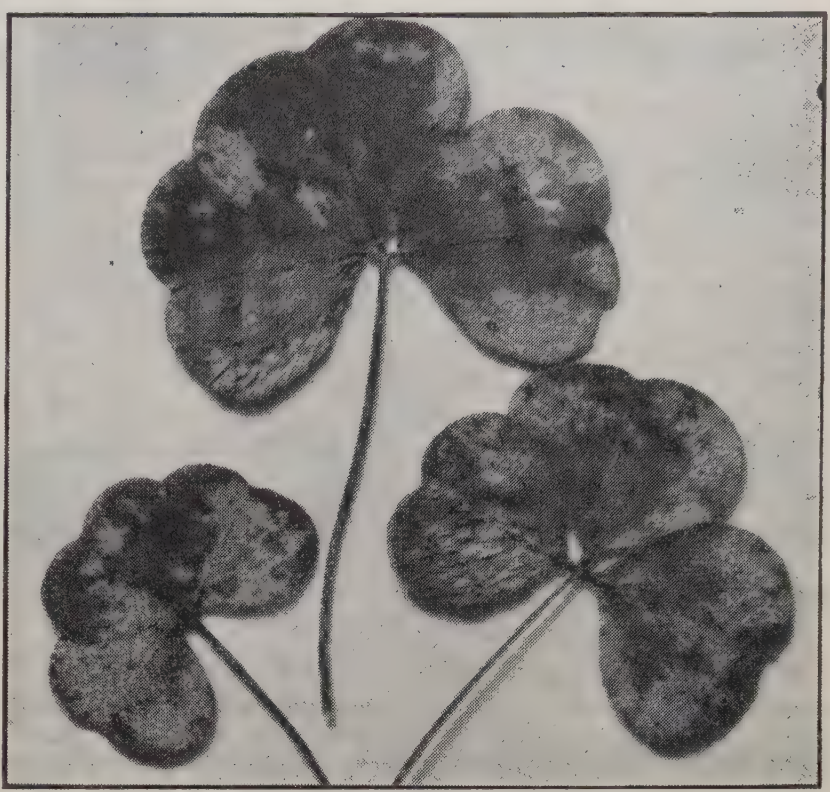

Fig. 2—Mottling caused by red-legged earth mite on the leaves of subterranean clover.

Autumn-sown crops such as peas and broad beans seem to suffer little damage during winter. Broad beans, with their tall growth and erect habit, are little damaged in spring, but peas may be seriously damaged and the pods blemished. The principal damage so far observed in New Zealand is to plants such as French beans germinating in spring, and to tomatoes immediately after planting out. Potatoes coming through the ground may be stunted and blackened, but once growth starts they seem to throw off the effects of the mite damage.

There is some evidence that the initial week or two after germination or planting is critical. Once the plant is established it appears to harden or become unpalatable to the mite.

Control Measures

It appears that the mite will be controllable at a reasonable cost, and the experience of market gardeners in Australia does not indicate that this pest will be a critical factor in production.

The effect of a single treatment with one of the materials recommended, on tomato plants in heavily-infested ground, is shown in Fig. 3. The results of treatment are really better than is shown, as many of the untreated plants were lying on the ground dead and withered and could not be photographed. There seems to be little or no prospect of controlling the mite by parasites or predators, as no effective organisms of this nature are known. There is a fungus disease, but it appears to be relatively unimportant.

In flower gardens, vegetable gardens, and market gardens it is desirable to reduce to a minimum the areas of waste ground such as headlands, fence lines, and ditches, especially if they carry rough and weedy growth which provides the mite with both shelter and food. Wherever possible the vegetation should be cleared off such areas. Where that is difficult, or where infested pasture adjoins the garden area, it will be necessary to rely on a barrier strip treated with materials such as diesel oil, creosote, D.D.T., or gammexane dusts or sprays. The cost and efficacy of these materials have not yet been investigated.

On the garden area freedom from weeds during the period when no crops are in the ground will help to

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A REQUEST for a New Zealand farmer penfriend has been received from Holland by the Netherlands Consulate, Wellington. The correspondent is a young man and is the son of a farmer. He wishes to correspond about farm management, wages, and prices in Holland and New Zealand. Inquiries should be addressed to the Netherlands Consulate, D.I.C. Building, Wellington.

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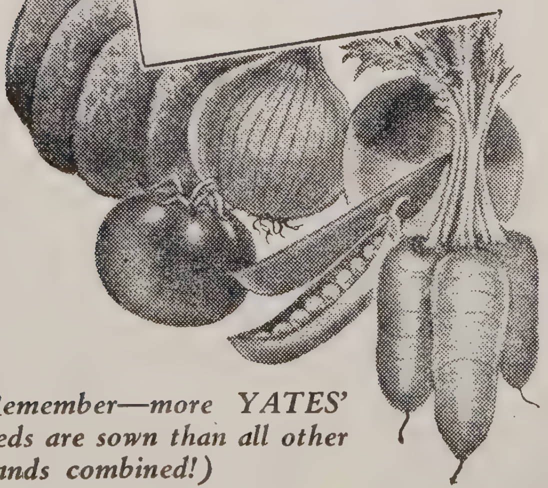

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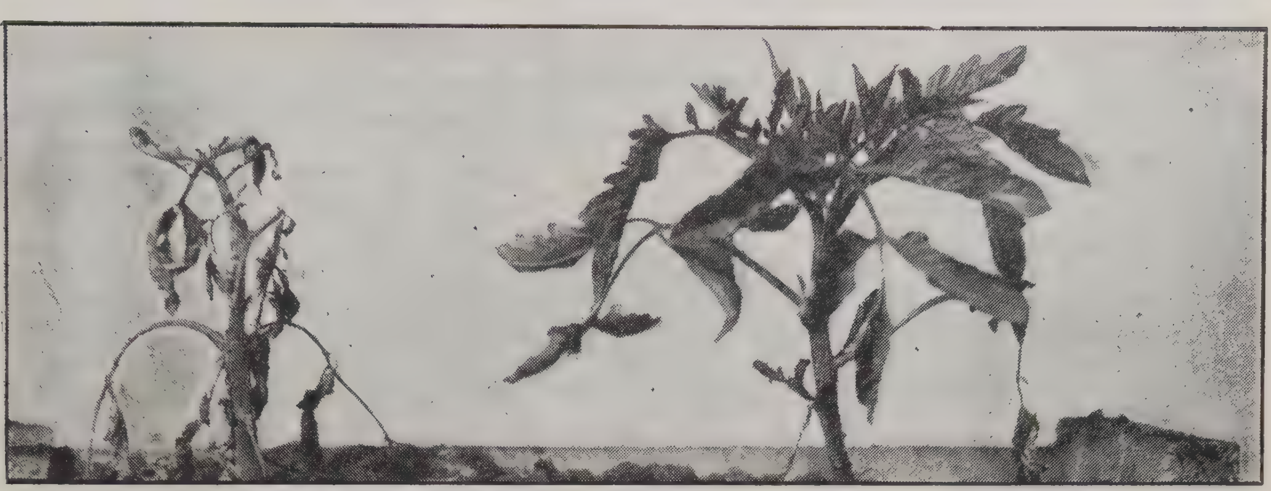


Fig. 3—Effects of treatment. Untreated plant on left. Plant on right treated with wettable D.D.T. spray (1lb. to 100 gallons). Tomato plants planted and treated (once only) on November 1, 1946. Photographed on November 12, 1946.

keep the numbers of the mite down, and cultivation at any time after the hatching of the eggs in autumn should serve the same purpose. Should it be necessary to reduce the numbers of the mite further before planting, that could be achieved by the use of sprays or dusts of D.D.T. or gammexane covering the whole area. Sprays such as 1lb. of wettable D.D.T. (20 per cent.) to 100 gallons of water would probably be cheapest.

For this purpose there may also be a use for the poison bait recommended in Australia: 45lb. of chaff, 3 gallons of water, 10lb. of sugar, and 1lb. of sodium arsenate. It is broadcast at a rate of 250lb. an acre.

Protection of Plants

A number of materials is known to give satisfactory results in protecting plants from the mite. Previously the best results were reported by Australian workers from nicotine preparations such as nicotine-white oil spray, 2 per cent. nicotine dust, or tobacco dust and slaked lime 4:1. In New Zealand a tobacco wash prepared from local tobacco shorts or coarse dust gave fair results, and there may be a use for the material in that form or as a dust if it is finely ground and mixed with slaked lime.

Young Farmers' Clubs Movement

A SPECIAL Young Farmers' Clubs Supplement published monthly and issued with the "Journal of Agriculture" to all active members of Young Farmers' Clubs contains reports of Y.F.C. activities, including monthly meetings of clubs and articles and news of value to members. Other persons interested, provided they are subscribers to the "Journal," may obtain copies of the supplement, post free, on application to the Dominion Secretary, N.Z. Federation of Young Farmers' Clubs (Inc.), P.O. Box 3004, Wellington.

Later work in Australia has indicated that 2 per cent. D.D.T. or gammexane dusts give good control, and these materials are likely to supersede nicotine in view of the much more persistent toxic residue which they leave on plants and ground because of their stability and insolubility in water.

Preliminary work carried out at Bay View, Hawke's Bay, in October-November, 1946, by the Entomology Division of the Department of Scientific and Industrial Research and the Horticulture Division of the Department of Agriculture has indicated that effective control of the mite at a reasonable cost can be obtained with any of the following materials:

Wettable D.D.T. (20 per cent. D.D.T. content), 1lb. to 100 gallons of water;

D.D.T. dust (2 per cent. D.D.T. content);

D.D.T. oil emulsion (3 per cent. D.D.T. content), 1 gallon to 100 gallons;

Blackleaf 40 1½ fl. oz., white oil 6 fl. oz., water 5 gallons.

These materials are not listed in order of merit, this season's work being insufficient for a decision on their relative efficacy. Good control of the mite was also secured with a 4 per cent. gammexane dust and a 5 per cent. dispersible gammexane powder at 1lb. to 100 gallons of water, but there was some indication of injury to the plants by this material.

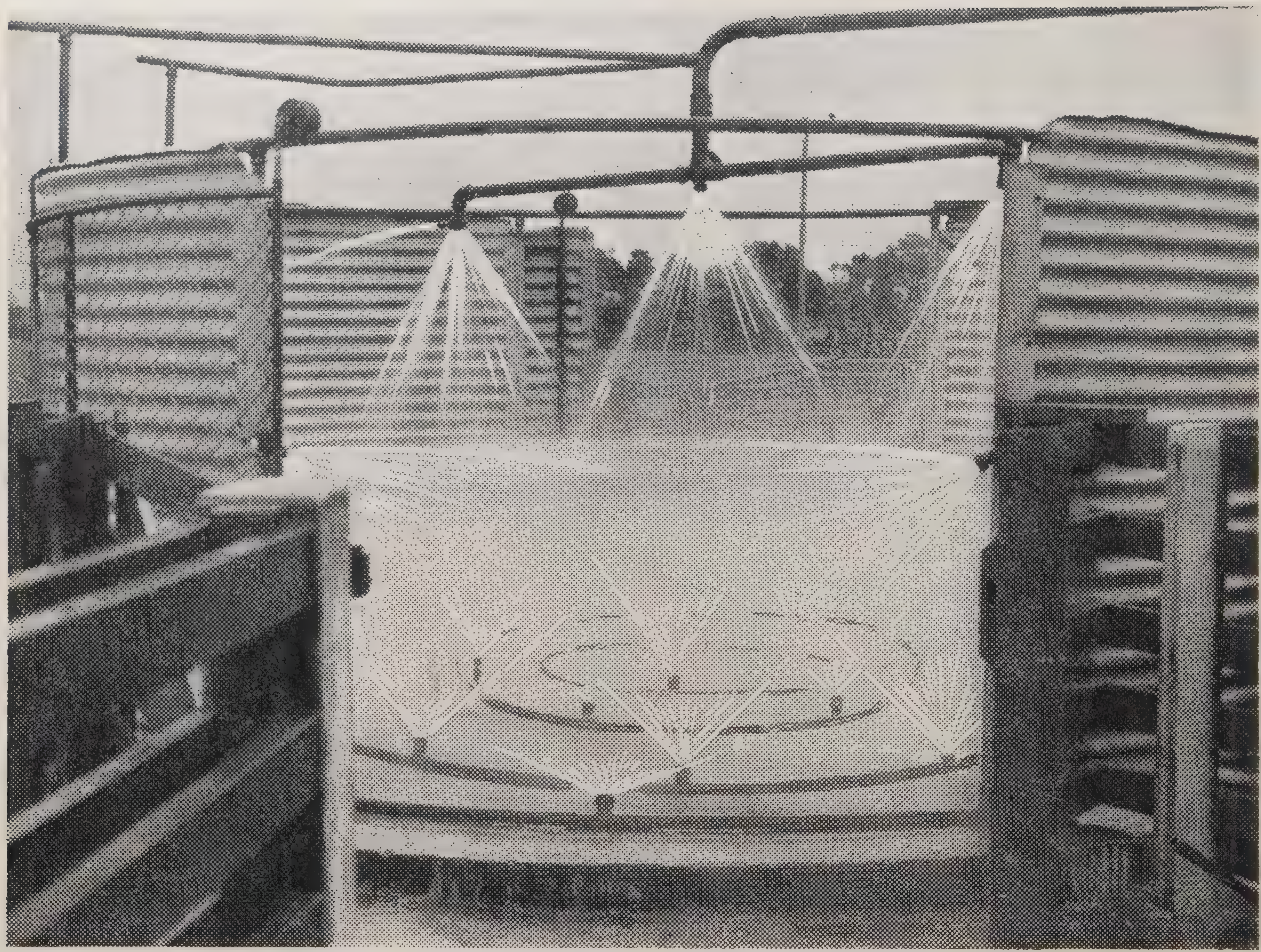
The wettable D.D.T. is probably the cheapest, as the price of the material is about 4s. a lb. and 50 gallons of 1-to-100 spray should cover 1 acre of small tomato plants at a cost for material of about 2s. an acre.

Early Protection Important

It is very important that germinating plants in infested ground should be given a protective dust or spray as soon as they appear above ground. Some damage may be done by the mites penetrating to the shoots of French beans and potatoes through cracks in the soil before they appear above ground. Similarly, plants such as tomatoes should be treated immediately they are planted out, as very severe damage may be done in the first few days.

It may be necessary to dust or spray the whole area of crops such as peas, aiming to kill the mites on the ground rather than on the plants. As the spray or dust deposit on the ground around the plant is probably an important factor in protection, it should be disturbed as little as possible during the first 1 to 2 weeks after application.

These statements on materials and concentrations are based on the limited work which was possible in 1946, but the materials listed are believed to be effective in controlling the mite, not injurious to plants, and unlikely to be substantially altered next season.



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TOPDRESSING A BETTER REMEDY FOR MINERAL DEFICIENCIES

By I. J. CUNNINGHAM, *Animal Research Station, Wallaceville.*

IN recent years a great deal of emphasis has been placed on the importance of minerals in the fodder of domestic stock. From writings in technical journals and in popular papers the stock farmer has learned that minerals are necessary for proper development of the skeleton, for the formation of digestive juices, for the building of blood and milk, and for many other processes of vital significance to the health and productivity of animals. All that is true. It is also true, and often left unsaid, that there is a limit to animals' need for minerals—that when the fodder contains sufficient, the addition of more minerals can achieve no useful purpose. In the widespread use of mineral supplements for cattle and sheep in New Zealand the amount of minerals already supplied in the pasture has been left unconsidered. There has been no pause to determine whether pasture supplies enough; it has been accepted as an article of faith that more minerals MUST be an advantage, and more have been offered in the ubiquitous lick box. No pause has been made, even, to calculate whether the mineral supplements offered and eaten increase in any significant way the total minerals eaten in the pasture.

IN this article these points are considered in turn: First, the daily amount of minerals required by stock; next, the quantities in the pasture; and, finally, the additional supply provided by the usual mineral supplement.

The most common supplement is a phosphatic lick, and it will therefore be most profitable to begin with a study of the virtues of such a supplement to a diet of pasture.

Daily Need of Phosphate

The daily requirement of phosphate varies with a number of factors. Age has an important influence, as the young growing animal obviously needs relatively more minerals than the adult; pregnancy implies the need of the foetus as well as of the adult; lactation imposes the additional requirement of the minerals contained in the milk. Species, too, has a considerable bearing on requirements.

The discussion can be simplified by confining it in the first instance to cattle, and by considering growing animals, adult dry stock, and adult lactating animals separately.

The best basis on which to estimate requirements for growth is a comparison with milk, as this foodstuff is specially designed by nature for the very young. Table I, adapted from Orr's "Minerals in Pastures," compares the minerals in a normal good pasture with those in milk, the content in each being calculated for the amount of the foodstuff which supplies the same amount of energy food value—1000 calories.

The table shows clearly that good pasture closely approximates milk in its mineral content and that the quantities of minerals and the balance between them are almost identical in the two foods. Pasture is not, of course, expected to replace milk in the very early period of growth, but it is the main source of food when the animal is growing nearer the weaning stage. At that time the requirement for minerals might be expected to alter. Archibald and Bennett in America have studied the amount of phosphoric acid needed for growth in dairy heifers up to the age of 3 years. They found that heifers made normal growth on diets which supplied:

In the first year 4.1 grammes of phosphoric acid (P_2O_5) per 100lb. live weight;
In the second year 3.9 grammes;
In the third year 2.8 grammes.
(28.4 grammes equal 1oz.)

Calculated as a percentage of the rations fed, to give a ready comparison with pasture composition, these figures represented 0.46, 0.50, and 0.40 per cent. of phosphoric acid (P_2O_5) in the three years.

Cows' Requirements

The requirement of dry adult cattle has been most thoroughly investigated in comprehensive experimental work carried out in South Africa by Theiler and Green. They showed that 30 grammes of phosphoric acid daily (about 1oz.) is sufficient to meet all the needs of a dry cow going through a normal pregnancy. Such a cow would eat at least 20lb. dry weight of fodder daily, and to meet her needs of phosphoric acid the fodder would therefore have to contain 0.33 per cent. of phosphoric acid.

A lactating cow needs extra phosphoric acid, and the quantity secreted in each gallon of milk is 10 grammes. A cow yielding 3 gallons of milk daily would, therefore, require 30 grammes of phosphoric acid for the milk. Adding to that the 30 grammes she would have needed if she were dry, the total requirement for a cow giving 3 gallons of milk a day is 60 grammes (about 2oz.) of phosphoric acid. The average-sized New Zealand cow would have to eat 25lb. of dry pasture to obtain the materials to make that milk; 0.53 per cent. in the food gives her the necessary intake of phosphoric acid.

The calculation of 0.33 per cent. of phosphoric acid in pasture for a dry pregnant cow and 0.53 per cent. for milk production must be further modified, because not all the phosphoric acid in the food can be absorbed into the body from the digestive tract. At least 75 per cent. of that in green grass is absorbed, so if the figures are increased by one-third they will represent the minimum quantities necessary for dry cows and milking cows. That means that a dry cow should have 0.4 per cent. of phosphoric acid in her fodder and a milking cow 0.7 per cent.

TABLE I

Comparison of Milk and Pasture: Minerals per 1000 Calories.

	Lime (CaO)	Phosphoric Acid (P_2O_5)	Soda (Na_2O)	Potash (K_2O)	Chloride (Cl)	Protein
Cow's milk	2.38	3.43	0.81	3.21	1.4	52.0
Pasture	3.64	2.75	0.94	11.54	3.5	65.0
Pasture %	0.98	0.75	0.25	3.1	0.94	17.5

The third line shows the composition of the pasture expressed in the conventional manner as a percentage in dried pasture.

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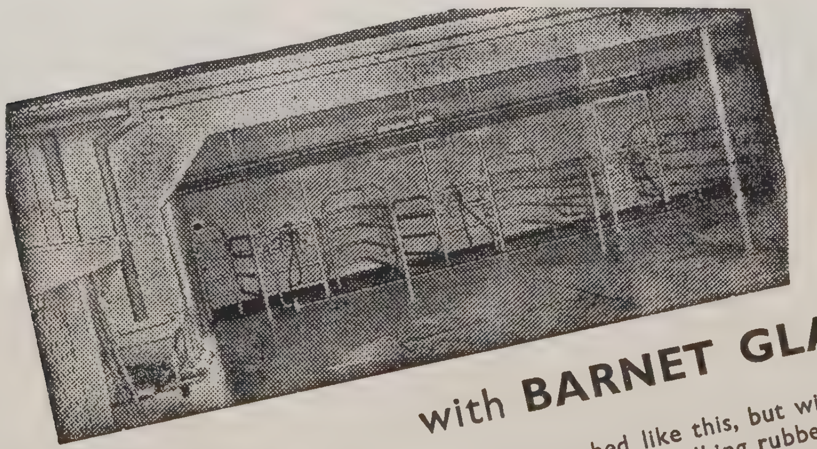

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The requirement for phosphoric acid in the diet of cattle can be summarised as follows: For growth and for non-milking, empty, or pregnant cows a pasture containing 0.5 per cent. of phosphoric acid supplies more than enough of this mineral; for high milk production the pasture should contain 0.7 per cent.

Supplies from Pasture

How far does New Zealand pasture meet these specifications?

A few typical figures for phosphoric acid content of pastures, taken from many published by B. C. Aston and his colleagues, are shown in table II below.

All these pastures clearly meet the requirements laid down for phosphoric acid for cattle. They are the good pastures of the Dominion, and those on which it is profitable and desirable to carry milking cows. Certainly no justification exists for feeding phosphatic supplements to cows on such pastures.

The value of mineral supplements can be examined in another way by calculating the quantities of minerals provided by mineral licks and comparing them with the intake from pasture. That has been done in table III. The composition of the lick has been assumed to be half bone flour and half agricultural salt, and consumption of this lick would be, on an average, 5oz. a head a week. The pasture has been assumed to contain 0.8 per cent. of phosphoric acid, 1 per cent. of lime, 0.28 per cent. of soda, and 1 per cent. of chloride, which is the approximate composition of a normal good pasture. The daily consumption of pasture has been taken as 25lb. of dry matter.

It is obvious that the contribution made by the lick is insignificant, though the lick used in the example contains as much phosphoric acid as it is feasible to incorporate. Many licks contain much less phosphate. It is evident, too, that good pasture is an adequate source of minerals and that there is no justification for attempting to add more to the ration.

Poorer Pastures

In New Zealand there are areas where pasture improvement and pasture quality are limited by low fertility and low available supplies of phosphate in the soil. On such areas the phosphate content of the pastures is below the level of 0.7 per cent. of phosphoric acid needed for milking cows. It is rare and undesirable for milking cows to be run on such pasture, where the feeding quality would be insufficient to support a profitable level of milk production. Limitation of production in such cases would be caused primarily by the low feeding value of the pasture—its low available protein and carbohydrates and its low digestibility—and not by low mineral supplies. The addition of minerals to such a pasture does not increase the amount of protein or of other constituents like carbohydrate which the animal can obtain from the grass.

In the past, cases of phosphorus-deficiency disease have been reported in milking cattle on such unimproved lands. The disease occurred in Taranaki and Wairarapa districts, and symptoms were relieved by feeding bone meal. Only in such cases, where a deficiency is actually recognised, are mineral supplements justified. Even then, however, treatment by licks is obviously only a temporary expedient and a grossly uneconomic one, as topdressing with superphosphate would increase the phosphate content of the pasture and relieve symptoms of the deficiency, and at the same time greatly improve the carrying capacity and productivity of the area.

TABLE II

Phosphoric Acid in a Random Selection of New Zealand Pastures.

Species of Pasture	Origin	Manurial treatment	Percentage P_2O_5 in Dried Pasture
Red Clover	Rotorua	Unmanured	0.75
White Clover ..	Rotorua	Unmanured	0.80
Cocksfoot	Rotorua	Superphosphate	0.87
Mixed	Wairoa	Superphosphate and lime	1.12
Mixed	Canterbury	Probably superphosphate	0.94
Mixed	Waikato	Probably superphosphate	0.77 to 1.45
Mixed	Poverty Bay	Probably superphosphate	0.67 to 1.13

TABLE III

Weekly Intake of Minerals Obtained by a Milking Cow from Lick and Pasture.

	From 6oz. of Lick (grammes)	From 175lb. of Pasture (grammes)	Required for a 3-gallon cow (grammes)
Phosphoric acid (P_2O_5)	19	633	420
Lime (CaO)	26	791	224
Chloride (Cl)	51	791	122
Sodium (Na)	34	198	70

There is no necessity to go exhaustively into requirements and supply of other minerals such as lime, magnesia, potash, and chloride, as it can be shown similarly that they are provided in good pasture in quantities adequate for all the needs of even heavily-milking cows.

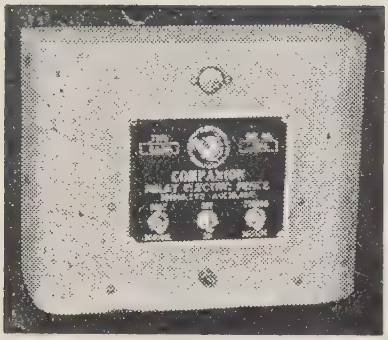
Minerals for Sheep

The question of minerals for sheep is similar to that for cattle, but the requirement is lower because the product harvested is lower in mineral content. The phosphoric acid requirement of a young growing sheep is about 3.5 grammes a day, which would be supplied in good pasture containing 0.5 per cent. of phosphoric acid. The requirement of a ewe producing about 3 pints of milk a day is 8½ grammes daily, which would be provided in good pasture containing 0.6 per cent. of phosphoric acid. These calculations have been made with due regard to the amount of food eaten and to the fact that some of the phosphoric acid in the fodder may not be absorbed into the body from the digestive tract.

On poorer pastures with lower phosphate content, growth or milk production could not be maintained at the same level as on good pasture. But lack of phosphorus is not the limiting factor; it is the poor quality of the pasture, its low digestibility, and its low content of proteins and carbohydrates. Workers in South Australia have shown that phosphate supplements for sheep run on areas extremely deficient in phosphorus do not cause any improvement in rate of growth or wool production. When parts of the same area were topdressed with superphosphate, however, the growth of the sheep did improve in direct relationship to the improvement in quality of pasture.

The conclusion reached was that there was no justification for the use of phosphatic licks for sheep, even in districts where low soil phosphate and low rainfall produced a herbage very low in phosphate. That conclusion is equally valid in New Zealand, where there are no areas as deficient in phosphate as that on which the South Australian work was done.

In table IV the amount of extra minerals supplied to a ewe by a lick is shown, as was done for a cow in table III. The same composition of lick and



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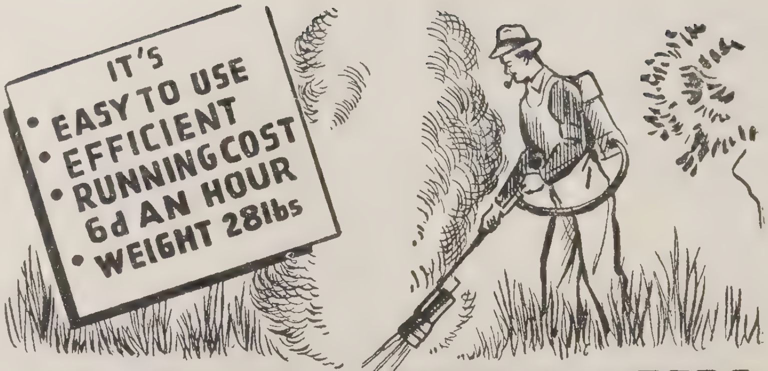

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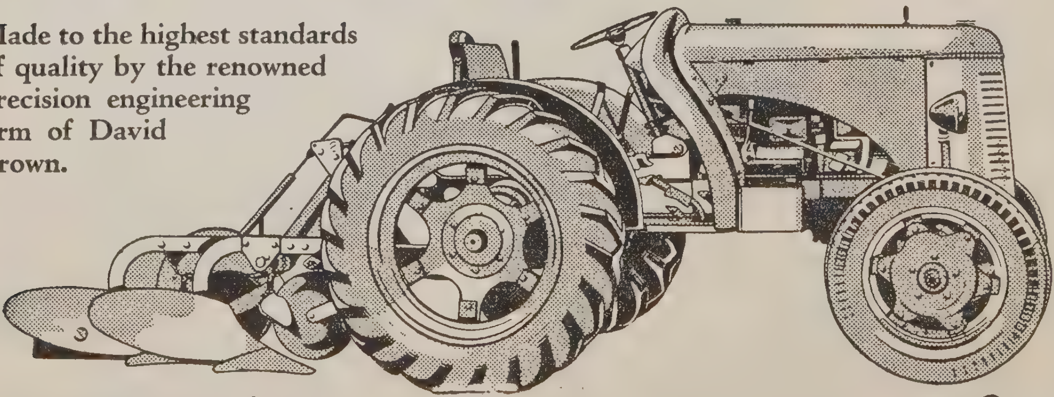

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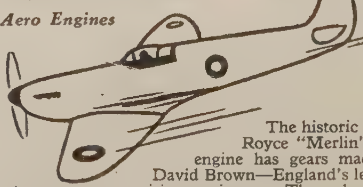

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DAVID BROWN—THE LARGEST ALL-ENGLISH TRACTOR BUILDERS

pasture is assumed, and the consumption of lick is taken as 2oz. a week and the pasture consumption as 4lb. of dry matter daily.

TABLE IV

Weekly Intake of Minerals Obtained by a Ewe from Lick and Pasture.

	From 2oz. Lick (grammes)	From 28lb. Pasture (grammes)
Phosphoric Acid (P_2O_5) ..	6	101
Lime (CaO)	9	127
Chloride (Cl)	17	127
Sodium (Na)	11	32

Arguments for Licks

Why is there such strong and widespread adherence to the use of licks? The first reason is probably that farmers can see the mineral matter of a lick and know that when stock eat licks they are eating minerals. It is forgotten that every 100lb. of pasture dry matter contains at least 6lb. of soluble mineral matter, and that therefore a cow would eat in its pasture about 10lb. of soluble minerals each week—very much more than the 6oz. she takes as a lick. And even if farmers mix their own licks, the cost is about £12 10s. a ton—a lot of money to pay for something that is already present in abundance in the daily feed of stock.

Other persistent arguments in favour of the use of licks are:—

1. **High-producing stock require the extra minerals.**—Stock can produce highly only on highly-improved pasture in which the phosphate and lime are adequate. The contribution of the lick in such cases has been shown to be negligible.

2. **Soil minerals are steadily depleted by milk production.**—10,000lb. of milk contains 20lb. of phosphoric acid. Even if that is produced in 1 acre, the phosphoric acid is returned in 1cwt. of superphosphate. On butterfat farms the phosphoric acid is not taken away but is redistributed by grazing pigs.

3. **The fact that stock will eat licks indicates that they require them.**—It is a common misconception that animals can determine their own food requirements and that, if given free choice, they would select a perfect diet. That view is largely an interpretation of observations that some improperly-fed animals develop a depraved appetite and will chew stones, sticks, old carcasses, bones, etc. Of all the objects chewed, bones are remembered best by observers, and the fact that they are chewed is taken as an indication of deficiency of bone-forming elements in the diet, and as proof that the animals know this and know that these elements are present in bones. The fact is that animals which develop depraved appetite will chew almost anything, and the object chewed may be wholly unrelated to the deficiency which caused the depraved appetite.

A few examples show that animals cannot be relied on to make a correct selection of diet: During outbreaks of facial eczema sheep will not eat good, safe hay but prefer the young, lush pasture which will cause facial eczema; cattle will eat ragwort until poisoned by it; they will eat many toxic plants, of which ngaio is an example, and be killed by doing so; they will chew old battery plates, or lick paint pots or painted buildings, and die of lead poisoning.

That animals cannot be relied on to recognise deficiency in the diet and how to cure it is shown by the fact that many will not eat easily-accessible licks containing cobalt, though they may be afflicted by cobalt deficiency almost to the point of death.

4. **Salt in particular is liked by stock and must be essential.**—Extra salt is necessary in some diets which do not contain enough and for animals in hot climates or under conditions of extra heavy work to replace salt lost in the sweat. As shown in table III, however, good pasture contains sufficient salt even for heavily-milking cows.

5. **Licks are favoured in many overseas countries.**—Concentrates are frequently employed there and many are abnormal in mineral content. For example, bran contains 2.5 per cent. of phosphoric acid and 0.1 per cent. of lime; obviously extra lime is necessary to give a proper balance.

Cobalt, Iodine, and Copper

So far consideration has been confined to the old-fashioned saltbone flour licks, which may be called non-specific licks because they are not employed for any specific purpose other than to obtain a general increase in mineral intake. There are in New Zealand certain areas where specific mineral deficiencies occur, and on these areas specific licks are profitably employed in certain circumstances. The only known deficiencies in New Zealand are of cobalt, iodine, and copper.

Cobalt deficiency occurs on pumice areas of the North Island, chiefly those derived from the Taupo and Kaharoa ash showers, but also from the Mairoa shower. In the South Island the deficient areas are the granite soils of Nelson, the pakihi soils, and Morton Mains soils.

Iodine deficiency occurs in parts of Manawatu, in areas of the Buller Valley (Westland), parts of Marlborough, in river valleys of Southland and Otago, and particularly in the Lakes District of Central Otago.

Copper deficiency occurs on practically all of the peat lands of New Zealand, particularly the areas in the region of Hamilton, the Hauraki Plains, Te Puke, Whakatane, Hawke's Bay, Shannon, Lake Ellesmere, and Southland.

Iodised salt licks have been used in New Zealand to control symptoms of iodine deficiency. Such licks are, of course, useful only where an iodine deficiency is known to exist. There appears to be no alternative to the use of licks in such cases, as topdressing with idodides is not practicable.

On cobalt- and copper-deficient areas the provision of regular supplies of these minerals to the stock is essential to maintain them in health. The best method is to increase the mineral content of the pasture by application of cobalt or of copper in topdressing. That is satisfactorily accomplished by annual topdressing with 5oz. of cobalt sulphate or 5lb. of copper sulphate an acre where appropriate.

Most of the cobalt-deficient areas must be topdressed with superphosphate to obtain an economic production of pasture. Cobalt sulphate is incorporated in superphosphate at fertiliser works, and the mixture can be applied for the same expenditure of labour as an application of superphosphate alone. Where cobaltised superphosphate is used annually no deficiency of cobalt exists.

Similarly, copperised superphosphate can now be bought and it is the most satisfactory method of controlling copper deficiency on areas which require superphosphate. However, some of the peat land does not require superphosphate, and in such cases topdressing does involve extra labour in mixing copper sulphate with lime before spreading it or in distributing copper sulphate alone.

Where the topography of the country is unsuited to topdressing, or where its present carrying capacity or potentialities for development do not warrant the expenditure of topdressing, licks provide the next choice of method. But even on rough and inaccessible country aerial topdressing may be the solution. A successful experiment has already been carried out with copper sulphate, and experiments with cobalt are projected.

Disadvantages of Licks

Licks can be regarded as definitely a second choice to topdressing, but one which must be taken in certain circumstances. They have certain disadvantages:—

1. **Lick consumption is uneven in a flock or herd,** so the correct quantity of the requisite mineral cannot be guaranteed each animal. Some do not take licks at all and some may take too much. Particular care must be

exercised in employing copper-containing licks for sheep. If the copper content is too high, poisoning can result; poisoning is possible if sheep have access to licks which contain the necessary amount of copper to be effective for cattle.

2. Regular care and considerable expenditure of labour are necessary to ensure that lick boxes are kept full.

3. Weathering causes loss of important ingredients, notably iodine.

4. Expense is higher than is generally believed. Copper sulphate for topdressing 2 acres, each with 5lb., costs 3s. 4d. If that area carried only 1 cow, the necessary amount of lick for a year would cost:

Home-mixed agricultural salt only + copper sulphate ..	1s. 8d.
Home-mixed bone flour + agricultural salt + copper sulphate	2s. 3d.
Commercial lick at £30 a ton	5s. 4d.

If the area carried 1 cow to the acre, as some peat lands do, the costs for lick would be doubled. Labour of providing the lick throughout the year is at least as great as for topdressing once. Similar considerations apply to cobalt.

5. The provision of licks does not improve the environment of the plant, in contrast to the effect of topdressing. That is not important for cobalt, as plants seem to have exceedingly low requirements, but it is important for copper, a deficiency of which may seriously hamper the growth and persistency of good pasture species.

6. No advantage can be expected from feeding minerals already adequately supplied in the ration, so a special lick is necessary for each deficiency. The expense of employing a shotgun type of lick which includes all minerals ever reported to be deficient can on no grounds be justified for general use.

Summary

The mineral needs of farm stock in New Zealand can be more satisfactorily provided by suitable methods of topdressing then by feeding mineral supplements, except in the case of iodine deficiency.

"Improved" pasture topdressed with superphosphate and lime supplies adequate quantities of phosphate, lime. and salt, and there is no necessity to provide licks containing these minerals, even for milking cows. Unimproved pasture is a poorer source of these minerals, but its limitations as a source of nutrition are primarily caused by the lower content of available organic nutrients, and not by the lower content of minerals.

Other major minerals, such as potassium and magnesium, are not discussed, as pasture provides these in ample amounts.

Known areas in New Zealand are naturally deficient in some trace minerals, the proved deficiencies being cobalt, iodine, and copper. Cobalt and copper can be most satisfactorily supplied by appropriately topdressing the pastures. If that cannot be done, mineral licks may be employed to supply the missing element. Where it is needed, iodine must be supplied in licks.

Aims of Veterinary Services Council

THE purpose of the Veterinary Services Act, 1946, which was passed during the most recent session of Parliament and came into force on October 9, is to provide for the establishment and maintenance of veterinary services for farmers on a national basis by setting up a Veterinary Services Council and defining its powers and functions. The council consists of three representatives of the Government; two representatives of the Dominion Federation of Farmers' Veterinary Services; two representatives of the New Zealand Dairy Board; and one each from the New Zealand Meat Producers' Board, the New Zealand Wool Board, and the New Zealand Veterinary Association.

IN general terms the functions of the council are to promote the establishment of efficient veterinary services for stock owners with a view to improving the quality of livestock and produce, and increasing production. In particular the council has power

1. To promote the formation of Farmers' Veterinary Clubs and grant financial assistance to them;
2. To promote superannuation schemes for its officers and servants and for veterinary surgeons employed by Farmers' Veterinary Clubs;
3. To promote the training of sufficient persons in veterinary science and their employment when qualified by granting bursaries to selected students;
4. To subsidise veterinary schools at which selected students will be trained;
5. To grant financial assistance to veterinary surgeons who wish to undertake post-graduate courses, or to provide post-graduate training for veterinary surgeons;
6. To establish and administer a scheme for refunding to stock owners who are not members of a Farmers' Veterinary Club part of the fees paid by them to veterinary surgeons or practitioners, or for payment to veterinarians of part of the fees payable by such stock owners;
7. To organise and co-ordinate the diffusion of information and advice on animal health and production.

Finance of Council

The council is required to prepare an estimate of its proposed net expenditure for each financial year ending on March 31. The net estimate for any year must not exceed £100,000. One half is payable by the Dairy Board, the Meat Producers' Board, and the Wool Board in the following proportions: Dairy Board eight-twelfths, Meat Producers' Board three-twelfths, and Wool Board one-twelfth. The amount payable by the Wool Board, however, is not to exceed £1666 in any year, and any additional amount required to satisfy the Wool Board's contribution will be met by the Meat Producers' Board until the Wool Board decides to assume full liability. The other half of the council's net estimated expenditure will come from Government subsidy.

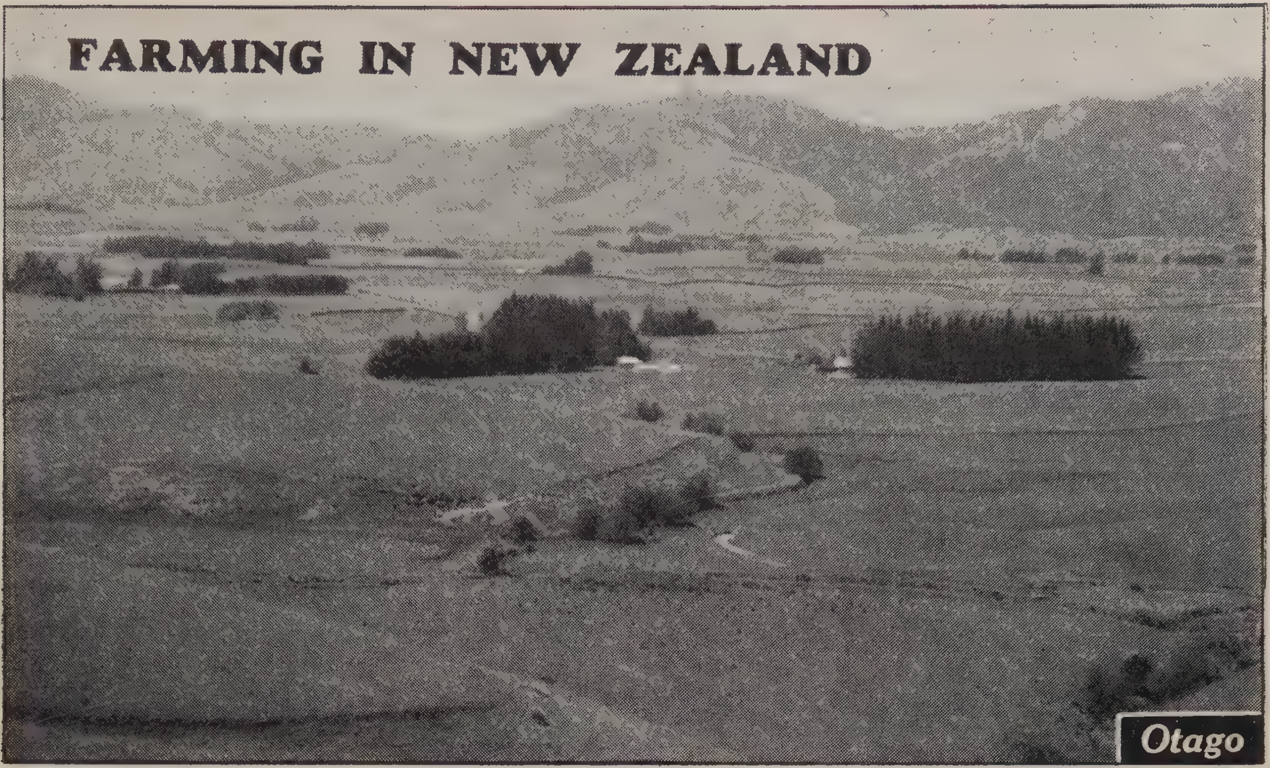
The Meat Producers' Board's contribution will be derived from the investment by the board of £500,000 which is authorised to be paid to the board for that purpose out of the Meat Industry Account. The Dairy Board and the Wool Board are authorised to pay their annual contributions out of their funds, but, with the authority of the Minister of Finance, the Dairy Board's contribution in any year may be paid out of the Dairy Industry Account.

The Minister of Finance may advance money toward the expenses of the council before the end of the financial year in which the council members are appointed, but the amount advanced will be deducted from the subsidy payable for the financial year starting on April 1, 1947.

The council is authorised to establish special funds or reserves for any purpose in the exercise of its functions and to invest money available for investment, including money in any special fund or reserve account, in stipulated securities.

The accounts of the council are to be audited by the Audit Office, and its annual report and statement of accounts must be sent to the Minister of Agriculture and copies to each of the contributory boards. A copy of the report and statement must be laid before Parliament.

FARMING IN NEW ZEALAND



OTAGO, with an area of 14,000 square miles, is the second largest province in New Zealand. It is bounded on the north by the Waitaki River and the great mountain peaks and glaciers of the Mount Cook region. On the west a narrow frontage is presented to the Tasman Sea round Milford Sound. On the south-west the boundary straggles down the Milford Track to Lake Te Anau, crosses Lake Wakatipu, thence to the Umbrella Mountains, and from there goes due south to the sea, which is the south-western boundary of the province. It is a territory of mountains, lakes, and rivers, with huge potential resources of water power which will prove much more important in both industrial and agricultural expansion of the province.

By J. W. WOODCOCK, *Assistant Director, Fields Division.*

THE climate and topography of the farming land are conducive to extensive rather than intensive farming. Consequently there has not been the same steady progress in recent years as in the North Island, where closer settlement and high production on farms have been reflected in marked increases of population in the towns and steady increases in the rural areas. The population of Otago during the past decade has decreased from 151,213 in 1936 to 144,035 in the 1945 Census, though the latter figure does not include troops overseas.

But it should not be presumed that Otago must always be a sparsely-populated area given only to extensive farming. In practically all districts are farms of small acreage and high production which compare favourably with intensive farms of other provinces. Some of the most fertile soils in New Zealand are in Otago, but in proportion to the size of the province those areas are small.

History of Province

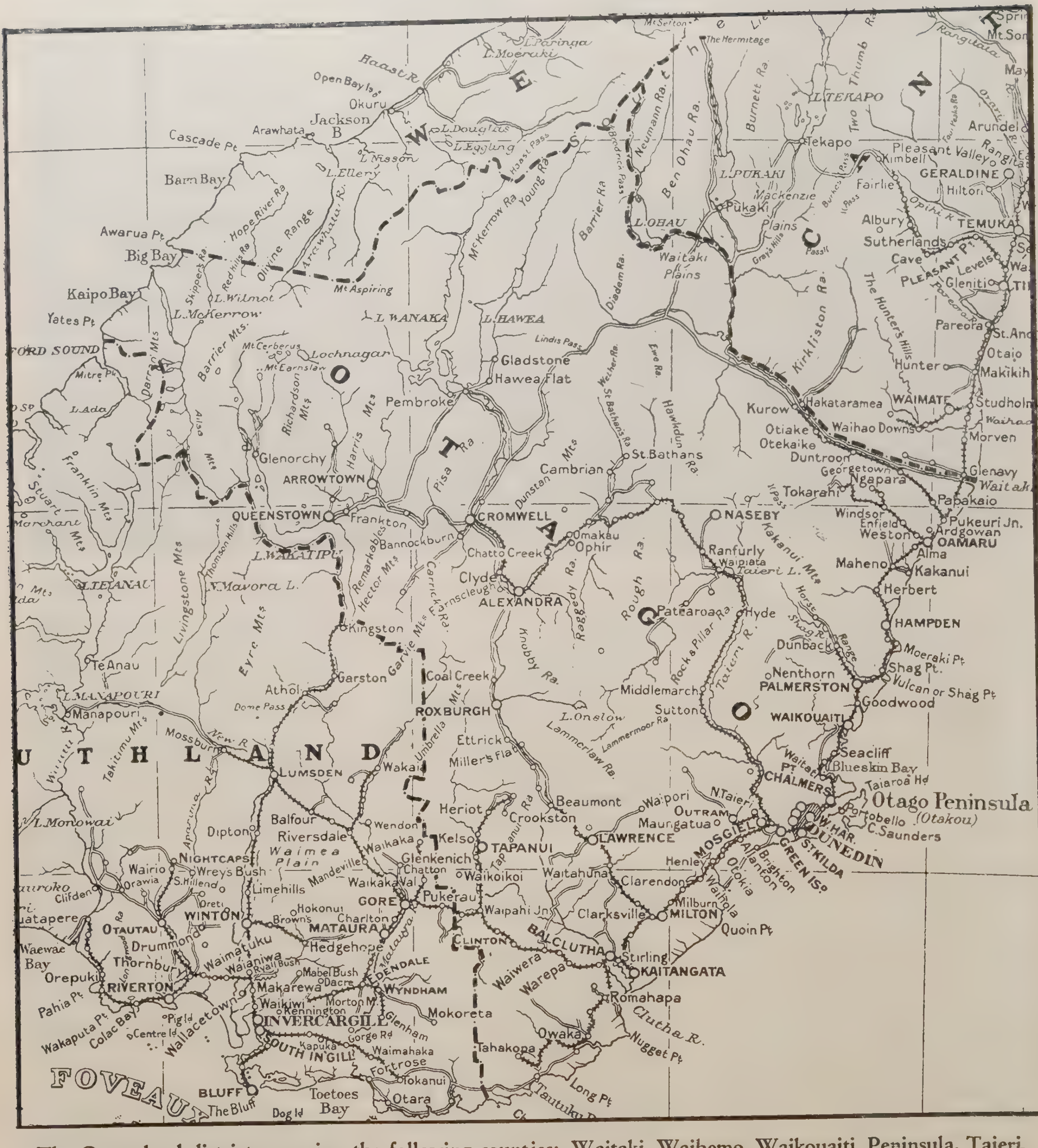
The earliest settlers of Otago were predominantly of Scottish origin. The first organised immigration, arranged by the Free Church of Scotland, resulted in the arrival of a party which, under the leadership of Captain Cargill, founded Dunedin in 1848. Previously, however, there had been some sporadic settlement, and even some farming had been started at Waikouaiti, where Mr. Johnnie Jones, a prosperous whaler, had bought land from the Maoris and turned his attention to agriculture. A considerable area of land in South Otago had also been surveyed and bought from the Natives, and it is on record that the Otago block of 400,000 acres, extending from the Otago Heads to the Catlins, was purchased in 1844 for £2400.

The first few years of the province's history were a period of difficulty, and much of the food grown by the settlers had to be gained by primitive methods after the hard labour of bush felling. Nevertheless the spread of settlement proceeded southward and westward, and by 1858 the sheep population had increased to almost 250,000. The discovery of gold in Central Otago paved the way for further exploration and increased settlement of that region, while the gold rush attracted population to Dunedin, which by 1863 had 79,000 residents. The demand for food for this large urban population considerably widened the scope of farming in nearby rural areas. Large areas of wheat and oats were grown on the rolling country of South Otago and shipped north from Port Molyneux; which was then a thriving port at the mouth of the river now known as the Clutha. But, lacking transport facilities to the coast, the inland areas depended on wool, and until the discovery of refrigeration these districts did not progress.

Effect of Refrigeration

The first cargo of refrigerated meat from New Zealand, obtained from sheep selected in North Otago by Mr. Thomas Brydone, was shipped from Port Chalmers in 1881. That was a milestone in the history of the Dominion, for the new industry which was opened up started a great expansion of grassland farming, not only in Otago but in New Zealand as a whole. Since then mutton and wool have been the

THE OTAGO PROVINCE


WESTLAND
CANTERBURY
OTAGO
SOUTHLAND
FOVEAUX
Haast R.
Open Bay Is.
Okuru
Jackson B
Arawhata
Cascade Pt
Barn Bay
Awarua Pt
Big Bay
Kaipo Bay
Yates Pt
L. Paringa
L. Moeraki
L. Douglas
L. Eggling
L. Nisson
L. Ellery
Mt Selton
The Hermitage
L. Tekapo
Tekapo
Burnett Ra.
Two Thumb Ra.
Neumann Ra.
Ben Ohau Ra.
Haast Pass
Young Ra.
McKerrow Ra.
Barrier Ra.
L. Pukaki
Pukaki
Mackenzie Plains
L. Ohau
Waitaki Plains
Mt Aspiring
Olivine Range
Hope River Ra.
Arawhata R.
L. Wilmot
L. McKerrow
L. Wanaka
L. Hawea
Lindis Pass
Diadem Ra.
Kirkliston Ra.
The Hunters Hills
Rangitata
Arundel
Pleasant Valley
Kimbell
Geraldine
Fairlie
Hilton
Albury
Temuka
Sutherlands
Cave
Pleasant Pt.
Levels
Gleniti
Pareora
St. Andrews
Otaio
Hunter
Makikihi
Waimate
Studholme
Waihao Downs
Morven
Glenavy
Waitaki
Kurow
Hakataramea
Otiake
Otekaike
Duntroon
Georgetown
Ngapara
Tokarahi
Papakaio
Pukeuri Jn.
Windsor
Enfield
Weston
Ardgowan
Oamaru
Alma
Maheno
Kakanui
Herbert
Hampden
Moeraki Pt
Shag Pt.
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Palmerston
Goodwood
Waikouaiti
Seacliff
Blueskin Bay
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Otago Peninsula (Otakou)
Portobello
C. Saunders
Dunedin
Pt Chalmers
W. Har.
St Kilda
Green Isd
Mosgiel
Brighton
Allanton
Otokia
Waihola
Milton
Milburn
Quoin Pt
Henley
Outram
N. Taieri
Maungatua
Waipori
Lawrence
Waitahuna
Clarendon
Clarksville
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Kaitangata
Balclutha
Romahapa
Clutha R.
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Owaka
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Mokoreta
Wyndham
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Morton M.
Glenham
Gorge Rd
Waimahaka
Fortrose
Tokanui
Otara
Toetoes Bay
Dog Id
Bluff
The Bluff
Invercargill
South Invercargill
Kennington
Kapuka
Waikiwi
Makarewa
Wallacetown
Centre Id
Pig Id
Colac Bay
Wakaputa Pt
Pahia Pt
Riverton
Orepuki
Waewae Bay
Thornbury
Drummond
Otautau
Waimatuku
Waianiwa
Ryall Bush
Clifden
Orawia
Wairio
Nightcaps
Wreys Bush
S. Hillend
Oreti
Winton
Limehills
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Hokonui
Brown's
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Clinton
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Glenkenich
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Kelso
Tapanui
Wendon
Riversdale
Waimea Plain
Balfour
Heriot
Crookston
Beaumont
Tapanui Ra.
Miller's Flat
Ettrick
Roxburgh
Wakaia
Umbrella Mts
Coal Creek
Lumsden
Mossburn
New R.
Garston
Athol
Dome Pass
Kingston
Garvie Mts
Remarkables
Hector Mts
Carrick Ra.
Bannockburn
Cromwell
Frankton
Queenstown
L. Wakatipu
Arrowtown
Glenorchy
Harris Mts
Richardson Mts
Pembroke
Pisa Ra.
Dunstan Mts
Cambrian
St. Bathans
St. Bathans Ra.
Hawkdun Ra.
Wether Ra.
Ewe Ra.
Gladstone
Hawea Flat
Lochnagar
Mt Cerberus
Mt Earnslaw
Barrier Mts
Darran Mts
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Milford Sound
Mitre Pk
L. Ada
Franklin Mts
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L. Te Anau
Te Anau
N. Mavora L.
Thomson Hills
Livingstone Mts
Eyre Mts
L. Manapouri
Manapouri
Takitimu Mts
Waiau R.
L. Monowai
Aparima R.
Chatto Creek
Clyde
Fruitlands
Alexandra
Omakau
Ophir
Raggedy Ra.
Rough Ra.
Knobby Ra.
Patearoa
Rock & Pillar Ra.
Hyde
Middlemarch
Sutton
L. Onslow
Lammerlaw Ra.
Lammermoor Ra.
Naseby
Ranfurly
Waipiata
Taieri L.
Kakanui Mts
Horse Range
Shag R.
Dunback
Nenthorn
Taieri R.
Waitati

The Otago land district comprises the following counties: Waitaki, Waihemo, Waikouaiti, Peninsula, Taieri, Bruce, Clutha, Tuapeka, Maniototo, Vincent, and Lake. In 1943-44 there were 7243 holdings in the land district, total area occupied was 8,124,621 acres, and average area of holdings was 1122 acres. Livestock statistics for the same year were: Horses 21,450, total cattle 111,143, dairy cows in milk 34,255, total pigs 11,246, sows one-year-old and over 1267, sheep shorn 3,390,432, lambs shorn 9556, and lambs tailed 1,971,842.

Dunedin, capital of the Otago Province, from the air. [*V. C. Browne photo.*

chief products of the province; the original Merino sheep has been replaced by the Romney on the lowlands, and the Corriedale, which originated in North Otago, has generally replaced the Merino on the easier ranges. The half-bred (first cross of Merino with a long-woolled breed) has also replaced the pure Merino on much of the high country.

With the expansion of the fat lamb industry on the lowlands, many of the once-popular English breeds such as the Leicester and Lincoln, which first replaced the Merino, have disappeared in favour of the Romney or Romney-crossbred, the ewes of which, mated with the Southdown ram, produce a good-grade lamb for export.

Diverse Production

Otago has a total of 8,000,000 acres of occupied land out of 43,000,000 in the Dominion, but only 1,500,000 acres has been improved, compared with 20,000,000 acres for the Dominion. The unimproved land is mostly tussock grassland, which occupies 5,500,000 acres, or 39 per cent. of the tussock land of New Zealand. That fact determines the preponderance of sheep and sheep products coming from the farms of Otago. One-ninth of the fat lambs exported from New Zealand are killed at the three freezing works in Otago.

AGRICULTURAL AREAS IN OTAGO (AVERAGE OF 1942-46 SEASONS)

AREA OF PROVINCE: 8,992,000 acres

OCCUPIED: 8,125,000 acres

UNOCCUPIED: 867,000 acres

	acres		acres
IMPROVED	1,519,000	**UNIMPROVED**	6,606,000
Pasture	1,260,200	Tussock	5,370,000
Fodder crops	116,000	Fern	480,000
Wheat	27,000	Bush	339,000
Oats for grain	9,000	Barren land	415,000
Oats for chaff	23,000	Phormium	2,000
Barley	5,600		
Linen flax and linseed	2,100		
Peas	3,000		
Potatoes	1,600		
Other crops	1,800		
Orchards	3,000		
Market gardens	1,000		
Plantations	37,700		
Fallow land, private gardens, etc.	28,000		

Cattle play only a minor part; there are 111,000 head, representing only 2½ per cent. of the Dominion's cattle population. Dairying is a minor industry, production of cheese being only 1½ per cent. and of butter less than 1 per cent. of the Dominion's output. There are, however, nearly 3,500,000 sheep in the province, representing 11½ per cent. in number and supplying 12 per cent. of New Zealand's wool production.

On the 1,500,000 acres of cultivated land Otago produces substantial quantities of wheat, oats, barley, and potatoes. Lucerne, turnips, and other fodder crops are also important as supplementary feed for stock, and very necessary with the relatively rigorous winter climate. Small seeds are harvested to a large extent—14 per cent. of the Dominion's seed is harvested in the province. The inland districts of Otago favour the production of fruit and grow 26 per cent. of the stone fruit and 6 per cent. of the pip fruit produced in the Dominion.

The province is thus one of the most diversely-farmed regions in New Zealand—in fact, probably no other area provides such contrasts in soil, climate, and farm production. Only a few miles may

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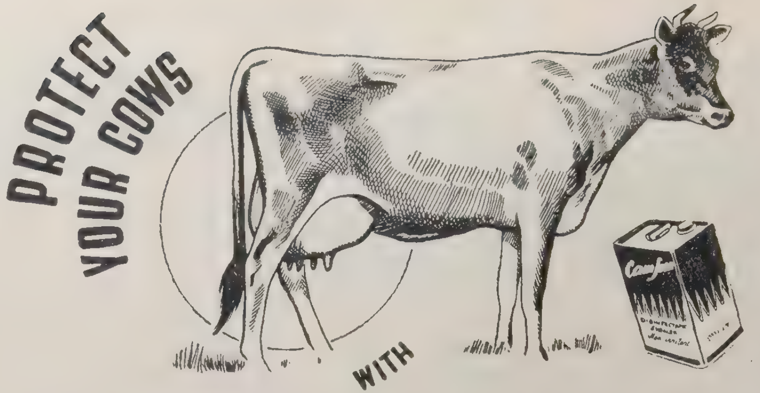

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Oamaru, principal town and seaport of North Otago, from the air. [*V. C. Browne photo*.

separate some of the richest soil in the Dominion from infertile settlements. Surrounding the city of Dunedin are almost barren hills, mostly covered with scrub except for clearings here and there on which hard-working farmers are producing milk for the city, while a few miles to the south lies the fertile Taieri Plain. Similarly, further inland there are huge tracts of barren mica schist land covered with little but scabweed on which are scattered, like oases in a desert, areas which irrigation water has transformed into highly-productive farms.

A marked feature of Otago is the undulating nature of the country and the relative smallness of the areas of really flat land. But the flat areas are generally exceedingly fertile, built up from rich alluvial deposits brought down by the rivers. Near the rivers there are also rolling downs of fairly high fertility, the parent soils being covered by loess blown up by the prevailing winds of bygone days. The erosion of the fertile soils from an arid central region and their subsequent carriage and deposition near the coast by the Rivers Clutha, Taieri, and Waitaki have, therefore, contributed a good deal to the fertility of an otherwise unpromising coastal belt.

Wide Variations between Regions

Otago can be divided into several regions which, because of wide variations in soil and climate, vary considerably in farming practices.

NORTH OTAGO

As the climate of North Otago is like that of Canterbury, there is a marked similarity in the agriculture of these two regions, especially away from the coast, where the rainfall is less and short-rotational farming is practised, so that cropping takes a larger place than in other parts of Otago. Wheat, oats, barley, and peas are cultivated, and pasture seed production is also important. Lucerne is widely grown, and much reliance is placed on hay for winter feeding, together with mangolds and greenfeed oats or barley. Swedes and turnips do not occupy the important position which they hold further south.

The Waitaki River, which is the northern boundary of North Otago, forms a fairly wide plain at its mouth, but the soil is somewhat thin and at places shingly. Irrigation of this land, which dries out badly on occasions, has often been mooted, but the unevenness of the contour caused by old river terraces presents some difficulties. On this land subterranean clover is fairly successful, and as this species does not seem to thrive further south, it appears that the 45th parallel—a line midway between the Equator and the South Pole which crosses the district just north of Oamaru—is the southern limit of subterranean clover.

Between the Waitaki River and the Kakanui Mountains is a large tract of rolling country of fairly high fertility but which often experiences long periods of low rainfall. Here lucerne is particularly valuable and its use is

CROMWELL FROM THE AIR

Cromwell, situated at the junction of the Kawarau and the Clutha Rivers, is a railway terminus serving a substantial mixed farming area in the Upper Clutha Valley.

spreading rapidly. Good yields of cereal crops are generally obtained and wheat thrives particularly well, especially the Dreadnought variety. The following table shows the yields from the three main varieties for the harvests of 1942-44:

YIELDS OF WHEAT IN NORTH OTAGO: BUSHELS AN ACRE

	1942	1943	1944
WAITAKI RIVERSIDE			
Dreadnought ..	4 .0	39.2	44.4
Hunters	40.5	39.0	39.4
Cross 7	38.5	35.6	36.0
WAITAKI DOWNS			
Dreadnought ..	54.1	44.8	52.9
Hunters	48.1	37.1	43.3
Cross 7	42.5	39.4	41.9

Cross 7 and, to a smaller extent, Hunters are used on the lighter land, while Dreadnought often secures the richest land. Yet there is no doubt that Cross 7, in spite of its lower yield, is encroaching on the area where Dreadnought used to prevail, largely because Cross 7 can be headed, whereas the other two varieties usually have to be binder cut.

More Market Gardening Likely

Near the coast to the south of Oamaru is a belt of black soil locally referred to as "tar." Though difficult to cultivate under certain conditions, this soil is extremely fertile. As it overlies limestone escarpments sloping to the sun, the soil retains the heat and is well drained, so that it is eminently suited to the production of early vegetables. The higher levels of these escarpments are fairly free from severe frosts and early potatoes are grown there successfully, seed of the Jersey Bennes variety being planted about July and dug about late November or early December.

Market gardening is likely to increase on this rich, black soil, and the Totara district is likely to become one of the main early vegetable districts in the South Island.

Further south an important poultry farming industry is established round Maheno and Herbert, no doubt because of the sunny, dry conditions as well as the ease with which poultry food, both greenstuff and grain, can be grown in the district.

Lime Production

With numerous outcrops of high-grade limestone, large quantities of agricultural lime are produced from the three limeworks in North Otago, and a good deal of it goes to Canterbury, where liming is becoming increasingly important. In contrast to most other lime-bearing country in New Zealand, which generally has a high lime requirement in the topsoil, the black soil of North Otago is not very deficient in lime, but south of Maheno, away from the limestone, the soil becomes more acid and liming should be more extensively practised.

Large quantities of agricultural lime are produced from the numerous outcrops of high-grade limestone in North Otago.

The production of vegetables, poultry products, and small seeds under a congenial climate offers considerable scope for closer settlement in the coastal portion of North Otago.

North Otago may be said to end at Palmerston, but the type of farming practised is more or less continued on the rolling country round Palmerston and Waikouaiti. There a well-established seed-growing industry specialises in Montgomery red clover production; the clay soil appears to suit the seeding of that species.

CENTRAL OTAGO

One of the most interesting regions in New Zealand is the large inland territory known as Central Otago, which lies to the east of Lakes Wanaka and Wakatipu and is almost totally surrounded by high mountains. The mountains rob the inblowing moisture-laden winds of the greater part of their moisture, so that generally the region is very arid, though in the neighbourhood of the lakes the rainfall becomes greater further west. The climate is hot in summer but in winter frosts are severe. The soil, mainly derived from mica schist, is generally well supplied with plant food and lime, though humus is often deficient and water is the main limiting factor.

Central Otago is dominated by the Clutha River and its tributaries the Kawarau and the Manuherikia, and settlement has been more concentrated along these rivers. Under the dry, sunny conditions fruit growing flourishes along these river valleys where irrigation water is available. On the uplands which constitute the greater part of the region only range farming is possible on the tussocks or on the meagre herbage which now remains. This tussock grassland is, however, a very important feature of Otago.

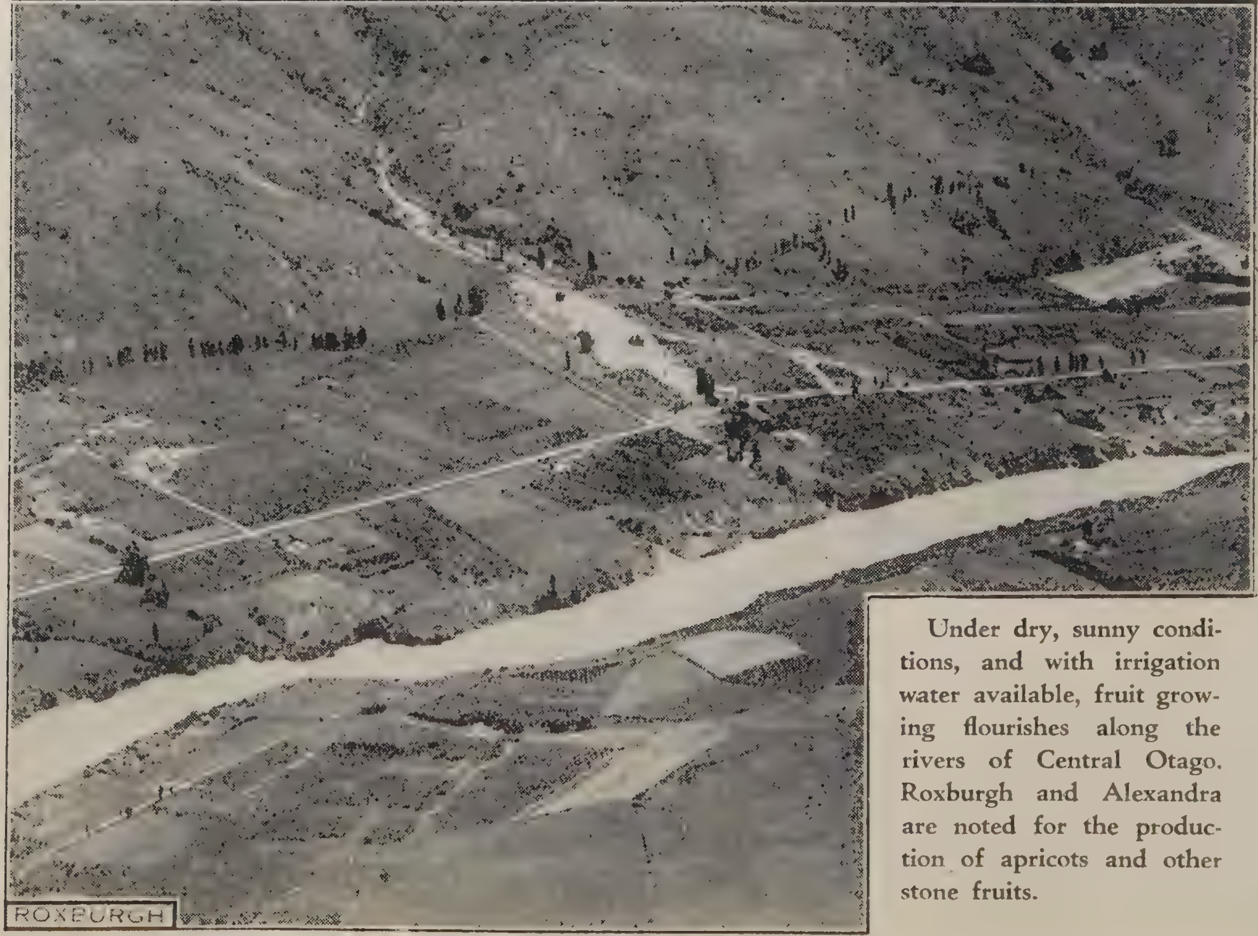
Tussock-land Farming

The tussock country is divided into large areas known as runs or sheep stations, which vary in size, some being many thousands of acres in extent. They include little flat land capable of cultivation and little fencing subdivision has been done. Most of the high country is subject to winter snowfalls, and the management and carrying capacities of the runs depend mainly on the area available for winter grazing. The sunny faces at lower altitudes are particularly valuable, as snow rarely lies on these slopes for more than short periods. The main object in the utilisation of the tussocks is the production of wool, and for that purpose Merino and Corriedale sheep are grazed on the high country. On the easier ranges near the eastern margin of Central Otago, where the climate is less severe, Merino halfbreds and Corriedales are dominant; they are preferred to the Merinos because their carcasses are more saleable and on this country the disposal of store stock is possible as well as the sale of wool.

The tussock grassland today is very different from the tussock of primitive times. When Europeans arrived they found tall, dense tussock with a close filling of other species between and in places patches of dense scrub.

Photographs on opposite page by V. C. Browne.

CENTRAL OTAGO FRUIT DISTRICTS



Under dry, sunny conditions, and with irrigation water available, fruit growing flourishes along the rivers of Central Otago. Roxburgh and Alexandra are noted for the production of apricots and other stone fruits.

Here was natural pasturage ready at hand, and with increasing settlement came the heyday of the sheep station. From 1875 a steady stream of settlers began a systematic exploration for sheep country.

It is easy to criticise now, but it cannot be denied that, in general, the tussock country was exploited rather than managed. Deterioration proceeded at an ever-increasing rate. The effects of this were noted by observers many years ago, especially in the more arid parts, and burning versus non-burning became a favourite topic of debate. Depletion set in, and on 750,000 acres the tussock has practically disappeared.

Causes of Deterioration

The chief causes of deterioration were overgrazing, excessive burning, the invasion of rabbits, and the lack of any continued and systematic procedure to counteract these causes. The results were apparent first in the disappearance of the species least tolerant to fire and overgrazing, including the more palatable species; and secondly in a weakening of the tussocks, with exposure of bare ground. The bare spaces became occupied by scabweed, and erosion of the ground between the patches of scabweed caused gravel and rock to be exposed, leading to desert conditions on more than 500,000 acres in Central Otago.

The following evidence presented before the Southern Pastoral Land Commission of 1920 indicated that tussock burning and overstocking were among the primary causes of deterioration:

> "With the exploitation of the tussock grassland for sheep grazing, the grazing animal—a factor unknown in primitive New Zealand—came into play. Unaided, the sheep would probably not have made much difference in the composition of the pasture except by eating out the few specially-palatable species, and so allowing those particularly aggressive to occupy the ground provided. But the sheep farmer early found out that none of the tussocks except the bluegrass was palatable, but that if burned, they would provide abundance of palatable feed in their young leaves. Consequently throughout the grasslands, year by year, the tussocks were set ablaze and year by year they were exposed to an increasing multitude of sheep."

This subject of burning has been much discussed recently in connection with erosion. K. B. Cumberland ("Burning Tussock Grassland," N.Z. Geographer, Vol. 1, No. 2, October, 1945), after reviewing all the evidence available, comes to the conclusion that not only does fire reduce the bulk and grazing value of the tussocks, but it also transforms the soil, exposing it to increased run-off and the influence of dry winds and severe frost. It eliminates the renewal of soil humus and fertility, which further weakens the tussocks. Gibbs, Raeside, and others ("Soil Erosion in the High Country of the South Island," Department of Scientific and Industrial Research Bulletin 92) consider that on the main soil types of Central Otago burning is warranted only for the destruction of matagouri, speargrass, and lawyer, but that, as the main reason for present-day burning is to forestall accidental fires, the runholder who ceases to burn and keeps his hillsides covered with tussock should be protected from carelessness by others.

Ravages of Rabbits

There can be no question that rabbits have been responsible for terrific defoliation and actual killing out of large areas of tussock after burning. In the warm, dry climate of Central Otago the rabbit has multiplied rapidly since its introduction. A vivid description of the ravages of this pest is contained in "The Naturalisation of Animals and Plants in New Zealand," by G. M. Thomson, in which Mr. James Begg describes the results of the influx of the rabbits in the following terms:—

> "About 1874 they began to make their presence felt in an unpleasant manner. By 1878 they had reached Lake Wakatipu, leaving a devastated country behind them. At the same time they had reached as far east as the Clutha River and a few years later had overrun the greater part of Otago, as well as the whole of Southland. Those were evil days for farmers, especially for the squatters who occupied large areas of grazing country. The fine natural grasses on which sheep and cattle grazed were almost totally destroyed. Sheep perished from starvation by hundreds of thousands, and it is no exaggeration to say that the majority of the squatters were ruined. On the old Burwood Station the number of sheep fell in one year from 110,000 to about 30,000. That was partly caused by heavy snow, but the rabbits prevented any recovery. It is doubtful if the same country today carries more than 40,000 sheep. From 1878 immense areas of grazing land were abandoned as the owners gave up the unequal struggle with the rabbits."

In Central Otago depletion from overstocking, overburning, and rabbits still proceeds, accentuated by the fact that the rainfall there is in the vicinity of 15in. a year, summer temperatures are high, and excessive frosts are experienced during the winter, all contributing factors to the inability of the plants to recover and reseed. Erosion by wind and water is slowly but surely converting what were formerly tussock-covered hills into barren rocky crags.

To arrest this deterioration burning should be avoided, land should be spelled, and the rabbit problem vigorously attacked on the basis that this animal is a pest and not an asset for the provision of skins. The river terraces should be either irrigated, if water is available for the purpose, or put down to pasture with low-producing but persistent grasses and kept in that state by careful grazing and the control of rabbits.

Benefits of Irrigation

Under irrigation Central Otago becomes a veritable garden where hardy and semi-hardy plants can be produced to perfection. Orchards of pip and stone fruits flourish, good tomato, small fruit, and root crops are produced, and dairy farming and the production of fat lambs are equal to those in any other part of the South Island. Under Government schemes 53,000 acres are under irrigation at present, while in county and private schemes about 20,000 acres are being irrigated.

The areas of flat land are generally covered with rich mica schist silt, though some portions are being badly wind eroded because of lack of vegetative cover. The application of water and the sowing of good pasture species usually bring immediate and dramatic results without the application of lime or fertilisers. The contrast between irrigated and unirrigated areas is amazing. One irrigated farm near Cromwell carries 3 and in some years up to 5 sheep an acre, while over the boundary fence unirrigated land is a desert and produces virtually nothing.

It may be asked why, if such dramatic results can be achieved, more land could not be watered. But in this arid climate supplies of available water are limited and most of the mountain streams have already been harnessed for the purpose. If the large volume of water in the Clutha River could be used, a large area could be brought into high production. A proposal has been mooted for the irrigation of about 20,000 acres in the Upper Clutha Valley, between Wanaka and Cromwell, but that would mean erecting an electric power plant and using the power to pump water from the Clutha River. Though there may be engineering difficulties which would prejudice the economic possibilities at present, this project or a modification of it is almost certain to eventuate. Until that time large areas

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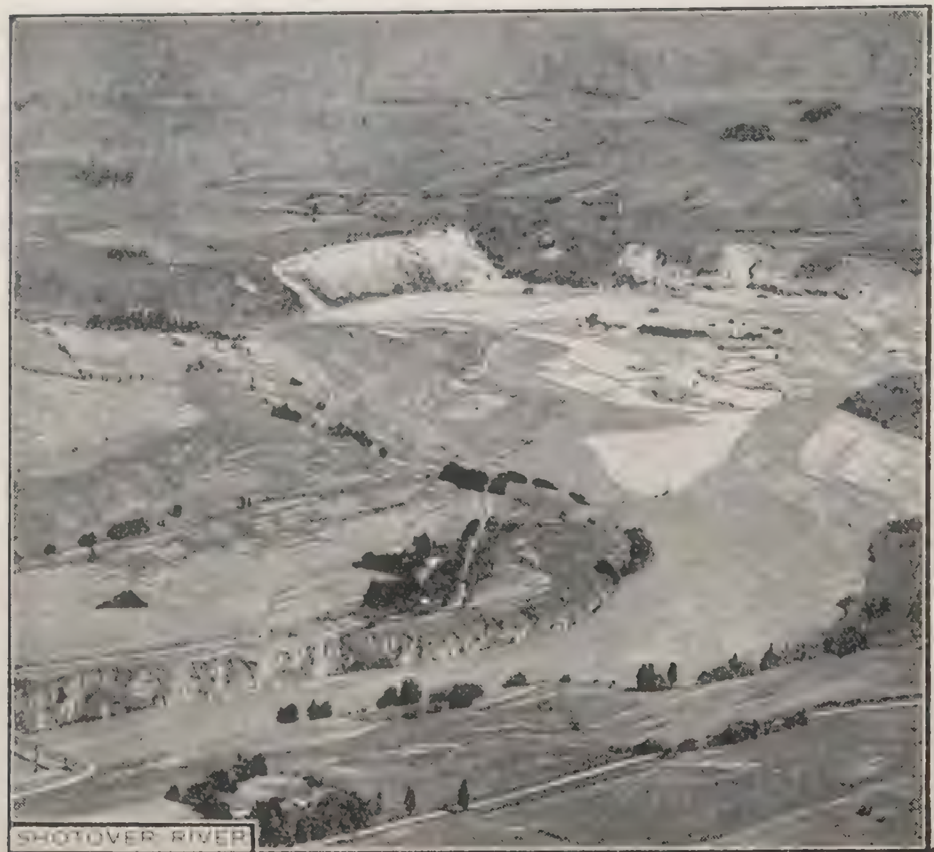
Photographs on opposite page by V. O. Browne.



SHOTOVER RIVER

THE LAKES DISTRICT

Lake Wakatipu, the second-largest lake in New Zealand, is the chief outlet for farm produce from the Shotover and Arrowtown districts, which produce barley, peas, small seeds, and wool. These are shipped by lake steamer from Queenstown to the railhead at Kingston.

QUEENSTOWN

of potentially fertile and easily worked but relatively barren land are likely to remain exposed to wind erosion and depletion of the topsoil, unless some organisation has the power to establish a herbage cover which would withstand these influences. Experience has shown that a reasonable herbage cover could be established if the area were kept free from rabbits and stocked judiciously.

Agricultural Districts

On considerable areas of Central Otago cropping can be carried out without irrigation. The Hawea Flat and the area bordering Lake Wanaka are noted for the quality and high yield of their barley. Wheat, peas, and brassica seeds can also be grown successfully. Similarly, on pockets of land near Queenstown and Arrowtown these crops do well and pasture seeds of high quality are produced. Cromwell, Clyde, and Alexandra are in the centre of the low-rainfall belt, the precipitation being only about 12 to 14in. a year, and apart from fruit growing, which is both extensive and successful under irrigation, these districts are devoted to grassland farming, with dairying and fat lamb raising where irrigation water is in adequate supply. In the Alexandra-Cromwell district there are about 60,000 pip fruit and 83,900 stone fruit trees.

In the Roxburgh district fruit growing and the raising of fat lambs are both important industries, though there a greater rainfall allows of some agriculture without irrigation. At Roxburgh there are 90,700 pip fruit and 91,500 stone fruit trees; of the latter about half are apricots.

The Maniototo Plain

A basin of about 350 square miles, the Maniototo Plain is bounded on the north by the Hawkdun Range, to the north-east by the Kakanui Mountains, to the east by the Rock and Pillar Range, and to the west by the Rough Ridge. The town of Ranfurly is about in the centre of this area. The floor of the basin is gently undulating, rising from 1000ft. above sea level on the eastern side to more than 1500ft. on the west, and is made up of gravel terraces and rolling downs. The Taieri River drains practically the whole of the Maniototo Plain and forms a swamp on an area which was formerly Taieri Lake.

Geographically the Maniototo is part of Central Otago, having most of the soil and temperature characteristics of that area, though the rainfall is slightly greater. In addition to sheep rearing, lucerne, cereal crops, and pasture seeds are grown. Before the advent of seed certification, when seed was largely recognised by the district of its origin, Maniototo ryegrass from short-rotational pastures was well known for its good physical appearance. With a steady increase in irrigation, the district is again becoming important for seed production from more permanent pastures.

A large scheme of further irrigation is contemplated for the Maniototo, involving the damming of the Taieri River and the flooding of 12,000 acres of the Styx Valley. The water is to be conveyed by a tunnel to the Maniototo Plain. The first stage of the scheme would involve only gravitation and is designed to irrigate between 30,000 and 50,000 acres.

It has been estimated that this would increase the production of the plain by 25,000 to 50,000 sheep, though a good deal depends on what use is made of the water available. The scheme can be expanded to irrigate a total of 89,000 acres. Whatever scheme is finally adopted, there is a likelihood of the Maniototo developing a large seed industry, in addition to appreciable increases in the sheep or cattle population.

THE LOWER TAIERI

The Taieri River breaks from Central Otago to the coast through a series of gorges, and near its mouth it has built up an extensive alluvial plain. As the silt deposited has been carried from the mica schist country, the Taieri Plain, under a generous rainfall, is highly fertile when adequately drained. Originally a swamp, it is essentially dairying country, and from here Dunedin, adjacent to the plain, obtains the bulk of its milk supply. But there is a surprisingly large number of sheep and fat lamb farms, probably outnumbering those devoted to dairying. The main vegetable requirements of Dunedin are also produced on the plain.

As may be expected, more difficulties are associated with this town milk supply area than in those further north, especially in the provision of winter feed. The period of pasture growth is relatively short, and unfortunately lucerne is not suited to the conditions except on the higher ground bordering the plain. Reliance therefore has to be placed on roots, chou moellier, and hay for the long winter feed period.

The Taieri River divides the plain into halves. The westerly portion, about 20,000 acres, has been protected by a stopbank, and the drainage, which is difficult on this area with little natural fall, is administered by the Taieri River Trust. Most of the dairying is carried out in this area, though there is also a good deal of mixed farming, with the growing of wheat, oats, and potatoes supplementing dairying or sheep raising.

On the opposite side of the river is an area of about 11,000 acres converging on to Mosgiel, the main centre of the Taieri Plain. This easterly side of the river has no floodbank, and nearby land which is subject to flooding can be used only for cattle grazing.

A region known as the Strath-Taieri, higher up the river, has the soil characteristics of the main Taieri Plain, the flat land having been formed from alluvial deposits, but it is considerably drier and is more suited to mixed farming with some seed production. Lucerne can also be grown successfully and provides valuable winter feed for the tussock country surrounding the Strath-Taieri.

THE TOKOMAIRIRO PLAIN

A few miles to the south of the lower Taieri Plain lies a prosperous farming area of about 14,000 acres known as the Tokomairiro Plain, situated about the township of Milton. Both the flat land and the surrounding hills were originally tussock covered, so this region received early attention from the first Otago settlers.

Being neither too wet nor too dry, the Tokomairiro is ideally suited for the production of fat lambs and the growing of cereal crops. The hills, where ploughable, carry reasonable pasture, but unfortunately after repeated burning the unploughable slopes have largely reverted to manuka scrub. Westward from Milton to Lawrence through the rolling country, this reversion to manuka on the steeper slopes is in marked contrast to the hills of Central Otago, where the soil is drier and less acid.

All the coastal land and particularly the hills are very deficient in lime. Fortunately there are extensive deposits of limestone at the northern end of the Tokomairiro Plain, and the two limeworks at present operating serve the whole of South Otago, where large dressings of lime are required if satisfactory pastures and root crops are to be grown.

THE LOWER CLUTHA

The Clutha River leaves Central Otago by a gorge at the northern tip of the Blue Mountains. Thence, until it forms a delta at the town of Balclutha, the river flows through a large stretch of undulating country which was originally in tussock but has been mostly cultivated and now under normal conditions runs to browntop. Under repeated cropping the ridges are liable to erosion of the topsoil, particularly on the exposed faces, and therefore the land varies considerably in fertility. Nevertheless the whole area is deficient in lime and phosphates. Good

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Photographs on opposite page by V. C. Browne.

HARVESTING OATS

Although such crops as wheat, barley, and oats can often be grown with ordinary farm methods in Central Otago, water is the main limiting factor for grassland production. Irrigation schemes are therefore important features of this region.

MANORBURN DAM

crops of wheat, oats, and linen flax have been produced in the past, but pastures appear to run out and become browntop dominant unless well limed or fertilised.

Nevertheless browntop is often exploited for seed production, and with prices for seed in the vicinity of 2s. 6d. a pound and a production of 40lb. an acre, without any necessity for labour except at harvest and without need for much capital or working expenditure, there is sometimes little incentive for pasture improvement. But fortunately there is a breed of farmers in South Otago which has the Scottish tradition of good husbandry; pride of the sheep flocks and the necessity for providing adequate winter feed by way of swedes and maintaining good pastures provide the incentive for progress.

There appears to be reasonable scope and ultimate need for greater development on this area by the subdivision of large holdings and the adoption of more intensive farming methods, though the long distances from the railway and high transport costs at present often preclude the large applications of lime essential for improvement.

THE CLUTHA DELTA

The Clutha River, dividing into two branches near its mouth, separates three almost equal areas of rich alluvial land. The northern portion, commonly known as the Matau, is a relatively-undrained region of 7000 acres lying between the Kaitangata Hills and the Clutha River and embracing the large shallow Lake Tuakitoto.

The island of Inch Clutha, lying between the Matau and Kau branches of the river, contains some of the richest soil in the Dominion. Enormous crops of cereals and roots are grown on the island, and farming there has reached a very high degree of efficiency. The Inch Clutha is noted for beef production, many cattle being carried on the large crops of swedes each winter. This region also produces most of the potatoes for the Dunedin market.

Across the river, on the south, is the Otanomomo, where dairying is the chief occupation. This plain was formerly a flax swamp, and the one remaining large flax plantation in Otago is located here.

These three areas are difficult to drain and parts are occasionally subjected to flooding. The drainage is administered by the Lower Clutha River Trust. An adequate drainage scheme on the Matau, which would involve pumping, would bring a good area into production, and probably enable dairying to be carried out on what is now Lake Tuakitoto.

THE CATLINS

To the south of the Clutha Delta and occupying a large area of the south-east coastal belt is the bush country known as the Catlins. This consists of small, fairly fertile valleys surrounded by scrub- and bush-clad hills. Generally, the climate is wet, cool, and dull, the rainfall being high (40 to 45in.) for Otago. The bush is chiefly kamahi and birch. As the result of leaching under this type of forest the soil is inclined to be acid and low in fertility. Where the bush was originally broadleaf and black pine the land is more fertile. Apart from the valleys, where settlement has been stabilised and the plough has been used, there does not seem any advantage in settling the unploughable country.

On the eastern boundary of the Catlins there is a tract which has been farmed since about 1865; the land is easier and large areas were originally ploughed and cropped with cereals, which were shipped north via Port Molyneux when that port was thriving. Today in this block of 17,000 acres there are 26 empty farmhouses, indicating the failure of many of the original settlers to farm this land.

No doubt the intensive cropping of this region in the early days has caused serious depletion of the soil. Probably the cultivated land can be built up by good farming methods, but there does not appear much hope for the unploughable areas which have reverted to scrub. On the foothills in South Otago manuka scrub invasion on unploughable land is a serious menace and cannot be easily overcome.

WEST OTAGO

To the west of the Blue Mountains is the valley of the Upper Pomahaka, a district known locally as West Otago, though geographically that name should be given to the coastal area near Milford Sound. This Upper Pomahaka Valley is one of the best agricultural districts of the south. The farmers there are renowned for the thoroughness of their cultivation, the ample crops they produce, and the quality of their livestock. At the annual ram and ewe fair at Heriot and the show at Kelso are to be seen the biggest-framed Romneys in the south. From the extensive rolling country extending from Tapanui to Roxburgh and away over the border into Southland comes a large number of flock replacements which are eagerly sought by fat lamb farmers of the plains of Otago and Southland.

On the easier land in West Otago fat lamb production, together with the occasional growing of cereal and seed crops, is the main type of farming. This country is considered ideal for the production of oats, particularly for milling, and heavy crops are frequently grown.

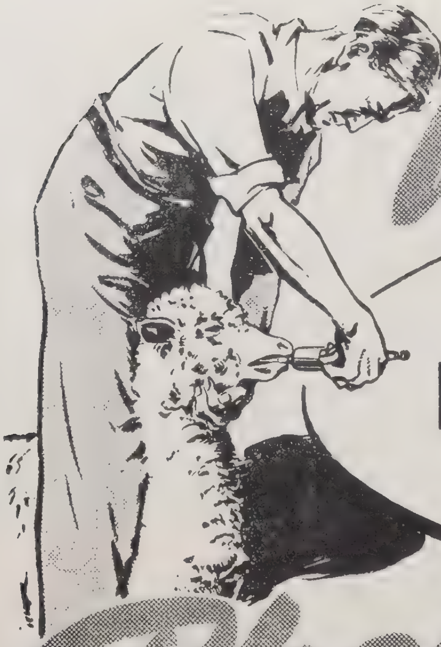
Future of Province

As in other parts of New Zealand, greater agricultural production in Otago is likely to be obtained with closer settlement by the subdivision of large holdings. But many Otago farmers are generally efficient in large-scale management and, especially where mechanisation is involved, the large farm may not necessarily be less productive than several small units on the same area. There are, in fact, several outstanding instances of efficient large-scale farming where modern methods and the use of labour-saving machinery are accompanied by high production. Certain types of soil and farming methods, however, lend themselves to the smaller holding, and the extension of irrigation will call for closer settlement.

Summarising these developments in Otago: There is a possibility of largely-increased production with the irrigation of about 110,000 additional acres in the Maniototo and Upper Clutha districts. Already a process of closer settlement is discernible in the coastal district of North Otago which is suitable for more intensive farming and the production of early vegetables, poultry, specialised crops, and small seeds. By the greater application of fertilisers and lime on about 200 square miles of the Clutha Downs the present carrying capacity of that area could be increased considerably. The expansion in these regions would still be in sheep products, cereal crops, and small seeds. Additional drainage schemes on the Taieri Plain and the Matau and Otanomomo districts of the Clutha Delta would enable dairying to be carried out on at least 5000 acres which are now used for spasmodic cattle grazing.

Apart from these developments there is scope for greatly-increased returns in other districts of Otago by the greater use of fertilisers and lime and the better utilisation of pasture growth. There is also need for research on problems affecting the large area of second- and third-class land on the coastal belt.

But hand in hand with these developments on the lowlands, the deterioration which has been proceeding on the high country, especially on the low-rainfall area, should receive attention. The post-war position of wool will have an important bearing on this problem as well as on the prosperity of Otago as a whole.



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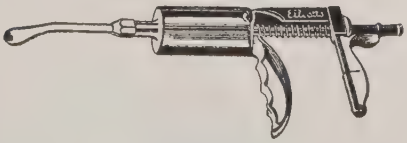

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By C. R. TAYLOR, *Fields Instructor, Rotorua.*

NEW ZEALAND'S harvest of hay each year is never so large that any avoidable loss can be afforded. Unfortunately, however, thousands of tons are lost each season through reasons which are well within the capacity of the average farmer to prevent. That these losses occur year after year suggests that all too many farmers do not appreciate fully the factors leading to preventable waste.

IT might be supposed that any reasonably dry spot in a field would prove a suitable site for a stack, and in most instances little loss results from stack-siting as practised today. But in some circumstances heavy losses can be sustained if careful attention is not given to the choice.

A few years ago a torrential rainfall in February caused a low-lying North Island district to become flooded for more than a week through the stop-banking to drains and other waterways breaking down under the tremendous volume of water they were carrying. Stacks located unduly close to those waterways were more seriously damaged than those built further away, though few escaped without some injury.

During the prolonged drought period last summer a considerable loss of hay was caused by stacks being set alight by passing locomotives. Had farmers visualised such a possibility they would undoubtedly have located their stacks further from the railway, but because they failed to do so many hundreds of tons of precious hay were destroyed.

In selecting a site for a haystack every contingency must be allowed for if the farmer is to have a reasonable guarantee against loss of valuable material.

Badly-based Stacks

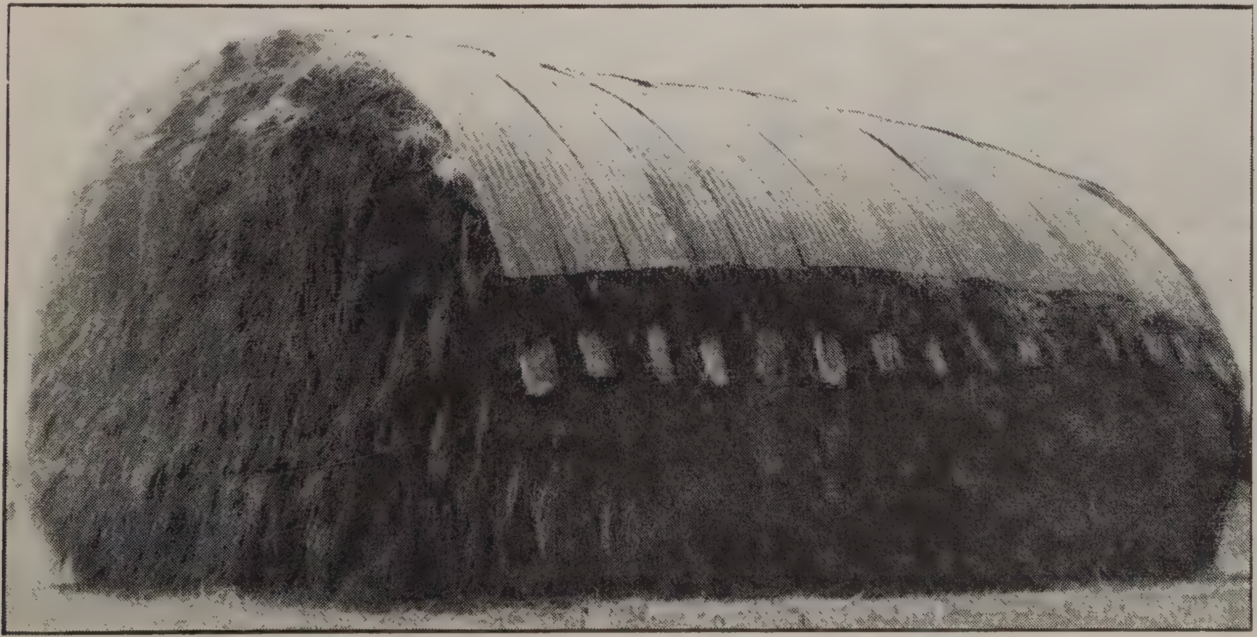
Because of the absorbent nature of well-saved hay, it is wasteful to build a stack with the material in contact, or practically in contact, with the soil. Many a farmer merely puts down a layer of bracken fern or manuka as a foundation on which he starts building a stack. Such a base is probably quite satisfactory for a time, but it is soon compressed under the great weight above. Being absorbent, it quickly leads soil moisture into the stack in much the same way as a sheet of blotting paper absorbs ink. The result is rotten hay in the bottom of the stack and some inferior-quality material higher up.

To prevent waste from this cause, construct a base of logs or old timber of substantial dimensions, covered with litter such as hedge trimmings, manuka, or scrub. Not only is the hay kept well clear of the ground, but an ample current of air can circulate under the stack, allowing earlier handling of the mown material than would otherwise be advisable and appreciably reducing the risk of spontaneous combustion later.

Faults in Building

Considerable waste from weather and fire is caused by faulty building—more often the result more of undue haste than of lack of knowledge, as harvesting time is usually one of bustle in an effort to head off possible bad weather. All too often grabful after grabful of hay is piled on with but little attempt to spread each evenly over part of the stack surface. That results in uneven settling of the stack and difficulty in preventing rain from entering to spoil much of the contents. A good stack-builder will spread his material evenly, keeping the heart of the stack solid and the sides and ends somewhat springy.

Even with otherwise well-built stacks, which have been properly proportioned in accordance with the amount of material available and well topped off, not infrequently the sides and roof are insufficiently raked to prevent the entrance of water. Some farmers appear to regard this essential feature of stack building as something to do with the presentation of a pleasing finish and nothing more. But if they can imagine how a bird or animal would fare in the rain if the feathers



A haystack well protected by corrugated iron held down by weights.

or hair did not point downward so as to shed as much water as possible, they will understand why the countless straws sticking out horizontally or upward from an unraked or poorly-raked stack will lead gallons of rain water in the hay.

Steep Roof More Efficient

Failure to prevent water from seeping into the centres of stacks because of improper covering causes heavy losses of hay. The coverage required depends largely on the type of roof given to the stack during its construction, but all types need at least some form of cover if rain is to be shed efficiently.

For a well-raked, steeply-pitched roof on an oblong or round stack, a few split manure bags sown together and securely held in place along the ridge-line, or placed over the peak of a round stack, will give all the protection necessary. But for a slightly-sloping roof a waterproof sheet or corrugated iron cover is essential, and both are relatively costly, even when freely available.

To reduce costs and maintain efficiency it is obvious that a high-pitched roof, well raked, is a more economic type of construction than the easily-built, "thrown-together" stack with a semi-flat roof which is common in many districts.

Whatever form of cover is employed, however, care should be taken to ensure that it is not blown away by the first boisterous wind. Various methods are used, but probably the best for fastening any type of cover is to attach weights by No. 8 wire. The wires should not be so long that the weights touch the ground when the stack has finally settled down. Unless the stack is roofed with corrugated iron, the wires should not be taken over the ridge-line and weighted at each end, as is common practice, for in time they cut their way into the stack and facilitate the entrance of rain.

Precautions Against Fire

The firing of stacks is another prolific cause of loss of hay each year, especially during unkindly harvesting weather, but it can be guarded against to some extent.

Large stacks are fired by spontaneous combustion much more easily than small ones, large "blocky" stacks are more readily fired than large long ones, and round stacks appear least liable to this trouble. Therefore, build narrow oblong stacks where substantial quantities of material are being handled, and preferably round ones where smaller amounts are being saved. Oblong stacks should generally be twice as long as they are wide; if built too narrow, they may topple over before they have settled down.

The type of stack construction undoubtedly has an important bearing on the problem of spontaneous combustion, but it is only a contributing factor. Properly-saved hay will rarely if ever fire, no matter how it is stacked, but if it is wet with rain or overcharged with its own sap when brought in to be stacked, the danger from firing is increased or lessened by the size and shape of the stack.

The primary cause of firing is badly-conditioned material, and though hay cannot be regarded as a difficult crop to grow, it is certainly difficult to secure without damage. To avoid the possibility of firing and the development of moulds, hay should not be stacked while it is in any degree wet with rain or containing too much sap. If small stacks or long narrow ones are built, the danger is still further reduced. However, should trouble be suspected after the stack has been completed, the safest plan is to turn the hay and rebuild it alongside, though an alternative that is often effective is to cut a piece out of the centre of the stack and remove it.

When opening an oblong stack for feeding out always cut from the leeward end. That should present no difficulty if in the first place the stack was sited end on to the bad weather quarter. Much hay loses feed value after being opened up because rain drifts into cut surfaces under pressure from high winds, especially when several days are taken to complete a cut.

Round stacks are usually fed out by removing the top and working down layer by layer. A less wasteful way is to remove sufficient of the top to form a foothold and then cut down in the usual manner, unless, of course, the stacks are very small and can be disposed of quickly.

SHOW DATES

THE following are dates and venues of A. and P. shows in February and March.

February 1—Katikati A. and P. at Katikati.

February 1—Clevedon A. and P. at Clevedon.

February 1—Golden Bay A. and P. at Takaka.

February 1—Rodney Agricultural Society at Warkworth.

February 4, 5—Feilding A. and P. at Feilding.

February 5—Te Puke A. and P. at Te Puke.

February 6, 7—Feilding Ram Fair at Feilding.

February 7—Waiwera A. and P. at Waiwera.

February 7, 8—Taranaki A. and P. at New Plymouth.

February 8—Woodville A. and P. at Woodville.

February 8—Te Awamutu A. and P. at Te Awamutu.

February 8—Hukerenui A. and P. at Hukerenui.

February 11, 12—Dannevirke A. and P. at Dannevirke.

February 12—North Kaipara Agricultural Association at Kaipara.

February 13—Dannevirke Ram Fair at Dannevirke.

February 14, 15—Franklin A. and P. at Franklin.

February 14, 15—Pukekohe A. and P. at Pukekohe.

February 15—Pahiatua A. and P. at Pahiatua.

February 15—Whakatane and Rangitaiki A. and P. at Whakatane.

February 19—Opotiki A. and P. at Opotiki.

February 19, 20—Ohura A. P. H. and I. at Matiere.

February 21, 22—Masterton A. and P. at Masterton.

February 21, 22—Auckland Metropolitan A. and P. at Auckland.

February 24, 25—Masterton Ram Fair at Masterton.

February 26, 27—Rangitikei A. and P. at Taihape.

March 1—Matamata A. and P. at Matamata.

March 1—Mangonui County A. and P. at Kaitaia.

March 1—Waimarino A. and P. at Raetihi.

March 1—Albany Fruitgrowers Association at Albany.

March 1—Maniototo A. and P. at Ranfurly.

March 5—Morrinsville A. and P. at Morrinsville.

March 8—Kumeu District Ag. and Hort. at Kumeu.

March 12—Lake County A. and P. at Arrowtown.

March 14, 15—Waikato Central A. and P. at Cambridge.

March 15—Hawke's Bay A. and P. at Napier.

March 15—Mayfield A. and P. at Mayfield.

March 15—Wellsford A. and P. at Wellsford.

March 25—Waimate A. and P. at Waimate.

March 29—Hawarden A. and P. at Hawarden.

March 29—Methven A. and P. at Methven.

March 29—Waverley A. and P. at Waverley.

THE HOME GARDEN IN FEBRUARY

"The hill hath not raised its head to heaven that perseverance cannot gain the summit in time."

—Dickens.

THOUGH the aspiring gardener may be aware that lack of knowledge of certain phases of gardening is a factor, perhaps the main reason, for his unsuccessful production, reflection on the words quoted above should engender confidence that perseverance will bring its reward. The following quotation from Riley is also applicable: "When working for results in your garden remember that the ripest peach is high on the tree."

By D. K. PRITCHARD, *Instructor in Vegetable Culture, Wellington.*

THOUGH the food value of tomatoes may be greater when the fruit is permitted to ripen on the vine, such a practice often encourages damage by birds. In most tomato-growing districts fruits on well-grown, early-set tomato plants should begin to change colour from mid-February. To secure these fruits for household use it is generally necessary to remove them as soon as they change colour. If they are left on the vines, birds will almost certainly destroy them long before they are red. Commercial growers, and no doubt many home gardeners, have had the experience of even immature, green tomatoes being picked by birds.

Ripening of Tomatoes

Tomatoes colour first inside. When the outside changes from green it assumes a light greenish yellow. The centre of such a fruit cut in two—this is properly done by cutting at right angles to the stem—will be a rich pink. Picked in the condition just described and kept in ordinary kitchen temperature, the fruits will ripen perfectly. They should not, however, be placed at a window and exposed to strong sunlight. This will induce sun-scorch, and render the skin tough and unpalatable.

In tomato-growing areas where trees provide ample shelter for birds, picking of fruits when they are just changing colour is the best means of preventing destruction of the earliest and best fruits.

Because of unfavourable weather this season, including late frosts in some tomato-growing districts, supplies of tomatoes from commercial growers will probably be below normal, and home gardeners should do everything possible to obtain maximum production from their tomato plants. Keeping plants closely tied to stakes, pruning out surplus shoots, shallow hoeing to destroy all weed growth, spraying at 10- to 12-day intervals with Bordeaux mixture, and judicious watering are the best means of guaranteeing ample supplies.

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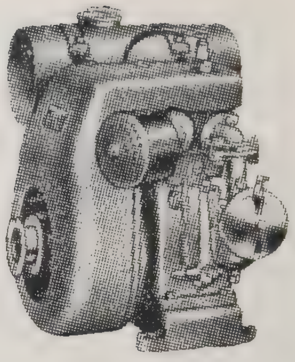

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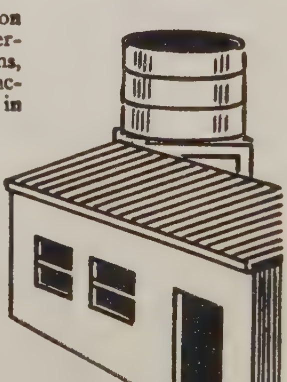

Lettuce

For late autumn and winter supplies of lettuce, seed may be sown during February. If the garden is full of vegetables, it may be convenient to use a small seedling box. Any kind of box will do, provided it is not less than 2 to 2½in. deep. Broadcast a small quantity of seed—a pinch will be sufficient—and lightly cover it with finely-sieved soil. To water the soil thoroughly the box may be soaked in a bath or washtub, then placed in a warm, shady place, not permitting the topsoil to become dry. After germination the seedlings may be watered with a watering can fitted with a fine rose. Imperial 615 and Neapolitan (Winter Market) are varieties recommended for this sowing.

Pumpkins, Squash, etc.

During prolonged periods of dry weather all varieties of the gourd family are likely to be attacked by aphides. These sucking insects are very destructive to plant life; they do not chew the foliage like slugs or caterpillars, but puncture the skin and suck the sap from leaves they attack. Many species of aphides and thrips are known carriers of disease. As a contact insecticide is necessary to destroy these pests, spraying with nicotine sulphate or paranaph is recommended. Dusting with derris is also effective.

To restrict plants running almost wholly to leaf and vine the growing points should be cut out when the runners reach a length of 4ft., which will induce fresh lateral growth and better fruit development.

Shallots

Shallots are usually harvested in February. Bulbs intended for long storage should not be roughly handled during harvesting, as this seriously impairs their keeping quality. They should be pulled and left to dry thoroughly before storing in a shed or outhouse where air circulation is good.

Eggplant

In northern districts where the eggplant is mostly grown, regular inspection of the crop is necessary for the detection of disease and attacks by insects and caterpillars. Eggplants are stated to be particularly sensitive to verticillum wilt and bacterial wilt, which also attack tomato plants. As little can be done to control these diseases, clean cultural practices and crop rotation are advised. Grubs and insects which attack eggplants can be fairly effectively controlled by insecticides.

Celery

In southern districts and the lower part of the North Island celery plants intended for use during winter should be set out before the end of February. In the Auckland Province plants set out much later will reach maturity.

Early-planted beds should now be producing well. It is not advisable to blanch more plants at one time than can be used before the next lot being blanched is ready for use. Once the stems lose their green colouring deterioration seems to take place more quickly than in the unblanched plant. Wrapping and fastening paper round the heads from the bottom of the plant to a little above the top of the ribs will usually induce sufficient blanching. The wrapping, however, should not extend to the soil around the plant, as this would prevent the air circulation necessary to assist in preventing development of injurious fungi.

Peas

Only in favourable localities should pea seed be sown at this time of the year to obtain a late crop. For this sowing a dwarf variety—W. F. Massey or Little Marvel—is recommended.

It is important that peas at present growing should have plenty of water, as the abundant foliage of tall-growing varieties transpires a large amount of water during dry, sunny weather. Pods should be picked when fully developed, but still tender.

If it is intended to save seed for next season, only pods from vigorous, disease-free plants should be selected.

Beans

The same recommendations as those given for peas apply generally to beans. The best dwarf variety is The Prince, which is stated to mature two weeks quicker than Canadian Wonder.

Silver Beet

In the early stages of growth many winter-maturing green vegetables are subject to attack by insects and disease, but silver beet (sometimes named Swiss chard or spinach beet), except under abnormally wet conditions, is almost immune from any serious form of disease.

Plants grown from seed sown in January should be set out as soon as they are large enough. Where drainage is good water may be applied liberally. Good results will be assured in ordinary garden soil if blood and bone manure is broadcast over the bed at 3 to 4oz. a square yard and well worked into the soil before planting. Silver beet plants can be set as close as 8in. apart in rows with 18in. spacing.

Cabbage for Spring

Home gardeners generally set out spring cabbage plants in early spring, but commercial growers endeavour to have supplies of this vegetable ready for harvesting from late July onward. To secure supplies of spring cabbages early in the season seed should be sown during February in northern districts and earlier in all parts of the South Island except Nelson.

Flower of Spring is the variety specially recommended. When the seedlings start to grow they should be protected against aphides and caterpillars. Recommendations made in the December issue of the "Journal" for protection of late autumn and winter crops will be found to be effective with young Flower of Spring plants.

Sow seed in the ordinary way, preferably in a box not less than 6in. deep.

Spinach

As the weather becomes cooler it will be worth making a sowing of spinach seed, Prickly or Winter variety. The seed should be sown sparingly in rows 12in. apart, and the soil should never be permitted to become dry after the seed germinates.

When the plants are half grown liquid manure applied weekly will produce tender, succulent leaves; quick growth is necessary to produce tender plants.

Kohl Rabi

Seed of kohl rabi may be sown in either spring or autumn. If sown during February in rich garden soil, good bulbs, which grow above ground, will be produced for use during winter. If soil conditions are not considered satisfactory, fertiliser as for cauliflower should be applied.

Seed may be sown in rows 12in. apart and the seedlings thinned to allow 6 to 8in. between the plants.

As kohl rabi is a member of the brassica family, it should not be grown in succession to cabbages or cauliflowers.

Chinese Cabbage

Chinese cabbage (*Brassica pekinensis* and *B. chinensis*) belongs to the brassicas, and should not follow a cabbage crop.

Soil and general culture should be as for cauliflower, but in autumn the seed is best sown in rows where the plants are to grow to maturity and thinned to 12in. apart; the distance between rows may be 16 to 20in.

The main varieties grown are Pe Tsai and Wong Bok.

VEGETABLE SEED GROWING IN THE HOME GARDEN

Many vegetables mature and go to seed during autumn. Home gardeners who desire to save seed from vegetables of their own growing should make a selection immediately.

When the varieties from which seed is to be saved have been decided special plants which are vigorous,

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Silver beet is almost immune from serious disease. Plants from seed sown in January may be set out 8in. apart in rows 18in. apart.

healthy, free from disease, and have all the best characteristics of the variety to which they belong should be marked. Indiscriminate plant selection cannot be recommended. Seed is the basis of a crop, and upon it to a large extent will depend the quality of the plants produced.

Following are references to a few vegetables from which the home gardener may easily make selections of seed:—

Beans

As the principal diseases which affect beans—halo blight, anthracnose, and common bean mosaic—in most cases are seed borne, it is important that in plant selection selected plants should be isolated as much as possible by the removal of adjoining plants which may be diseased. As disease spores can be spread by human agency, plants selected for seed production should never be handled after contact with diseased plants, unless the hands are washed in water to which some disinfectant has been added. Only the best-shaped pods should be allowed to mature on the vines for seed.

Peas

Diseases of peas which are manifested by brown sunken spots on leaves and pods are caused by fungi which ultimately find their way to the seed. No plant showing indications of these affections should be selected for seed production. All pea seed, whether bought or produced in the home garden, should be thoroughly examined before sowing, and any showing brown or coloured spots should be burnt.

Carrots

Seed should not be produced from carrots during the first season's growth. For seed production carrots are biennials, and only the best-shaped roots should be retained for planting the following spring. No plant which shows yellow or chlorotic foliage should be selected. Carrots are self-fertile, but often cross-pollinate; protection at the flowering stage may be advisable.

Tomatoes

Selected fruits from specially-chosen tomato plants should be saved for seed. They should be fully ripened, and are better for seed saving if ripened on the vine. The tomatoes should be cut at right angles to the stem and the contents, including the pulp, squeezed out into an enamelled or earthenware container. If this is kept in the usual house temperature for 48 to 72 hours and stirred frequently with a small piece of wood, the pulp should separate from the seed. The pulp can then be removed by washing several times with plenty of water. Finally, the seed should be strained in a fine sieve and spread out to dry as quickly as possible.

Lettuce

Seed may also be saved from specially-selected lettuce plants, as there is little chance of cross-fertilisation. Lettuces are shallow-rooting plants, and the flowering heads should be protected against stormy conditions. Ripe branches should be cut close to the main stem, tied in small bunches, and hung in a moderately warm place where there is a good current of fresh air. The seeds may be harvested after ripening by rubbing the seed heads carefully between the hands, and, if passed through a fine sieve, most of the foreign substance can be removed.

Cabbage or Cauliflower

In attempting to save seed from any plants of the brassica family it should be realised that unless the plant or plants selected are adequately protected, cross-fertilisation is inevitable, with disastrous results. However, the work is interesting, and, if carried out properly, may be profitable from the point of view of gaining experience.

When selected cabbage plants have reached maturity emergence of the developing seed stalk will be made easier if a shallow cut, the shape of an X, is made across the head.

It is usual with cauliflowers to permit a few heads to remain close together so that a good selection can be made. As these mature undesirable types are removed and used in the ordinary way, thus allowing more space for the seeding plants.

Before the flowering stage is reached, with either cabbages or cauliflowers, the plants must be completely covered from ground level so that there is no possibility of pollen-bearing insects coming in contact with the plants during the flowering period. Unless this is done, seed production of brassica crops should not be attempted, the danger of cross-pollination being too great.

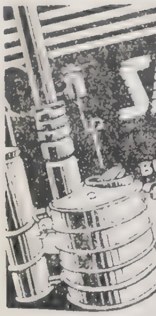
The seed heads may be treated after ripening in the manner recommended for lettuces.

All seeds must be thoroughly dried before storing.

COMMERCIAL VEGETABLE GROWING FOR EX-SERVICEMEN

Many enquiries have been received from ex-servicemen concerning horticulture, and particularly vegetable growing, as a future occupation.

The desire for a few acres of land—any kind of land—on which to build a home and begin an outdoor life of profitable employment is quite understandable, but little consideration seems to have been given by most inquirers to the capital investment which may be involved. Nor has sufficient consideration been given to proximity to favourable markets for produce grown, suitability of the area selected or of the soil for the crops it is intended to grow, the availability of assistance—if and when required—by



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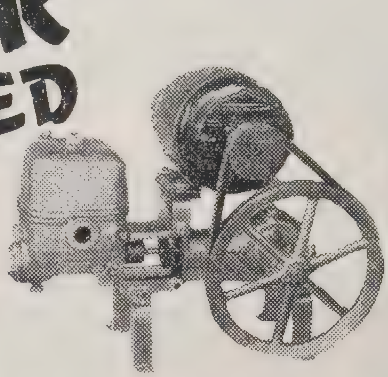

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seasonal workers during harvesting periods, and, what is of infinitely greater importance, the experience necessary to ensure success in any horticultural activities.

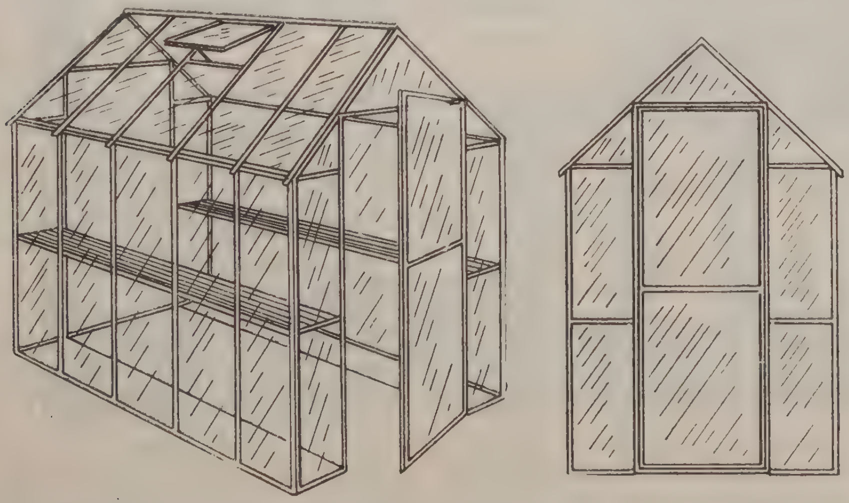
Reluctance by those engaged in horticulture to give information on financial returns during the war should not be misunderstood or misinterpreted to mean that there is any desire to keep newcomers out of the horticultural business. Experience would seem to justify the opinion of practical men that neither the volume of trade nor the market values which have generally ruled during the past few years will be sustained and that the future must be approached with caution.

The few points stated above and others of at least equal importance should receive full consideration before action is taken to acquire a holding. The matter is of such vital importance to ex-servicemen that persons qualified to give reliable and practical advice concerning the various aspects of horticulture should first be consulted.

A GLASSHOUSE ON THE FARM

The erection of a small glasshouse would add to the many and varied activities of farm life. If the scarcity of labour and building material can be overcome, the advantages of a small glasshouse which could be used among other purposes for the propagation of vegetable and flowering plants are so obvious that the suggestion should be earnestly considered by all those interested in the proper and profitable maintenance of a farm garden.

There is usually to be found around most farms some spare timber which would be suitable for studs up to 4ft. long and material suitable for top and bottom plates should be procurable. Sash bars, usually made from totara or redwood, would have to be bought.



Diagrams of a small glasshouse which would greatly extend the possibilities of home and farm gardening.

The size of the glasshouse would be determined by the amount of propagation necessary to meet the plant requirements of the farm and other uses for which it might be found convenient. A house 20ft. x 10ft. would provide about 150 square feet of bench accommodation, with a comfortable working passageway between the benches. Provided the benches were made removable, a late crop of tomatoes might be grown in the centre of the house when plant growing was finished.

From the brief particulars given above and the assistance of the accompanying diagrams it should be possible for interested gardeners to draft plans for a small glasshouse.

ASPARAGUS GROWING FOR EX-SERVICEMEN AND OTHERS

Many aspirants for "a life on the land" appear to think that asparagus growing offers unlimited possibilities at present.

Though the financial commitments involved in the settlement and establishment of a settler on, say, 10 acres of land suitable for the production of asparagus and general horticulture cannot be dealt with here, an outline may be given of the cultural procedure necessary for the successful establishment of a commercial asparagus plantation.

Areas planted in recent years are now producing asparagus which is being used for canning and to supply fresh fruit and vegetable markets.

The retail price of asparagus might well lead a prospective grower to think that producers of asparagus must be reaping handsome financial returns and might induce an ex-serviceman to look around for land. He may be lucky enough to locate 10 acres suitable for the production of asparagus and other horticultural crops which could be acquired in February. If the land is in pasture, so much the better.

The first operation necessary is to skim plough the area intended for asparagus to a depth of 4 or 5in.

If plants, generally termed crowns, are to be purchased, these should be planted in August.

Cutting spears is not recommended from the first year's growth. Probably during late October or in November, 1948, a light cutting may be made, but cutting should not extend beyond two weeks. In the same months of 1949 the cutting of spears may be extended to, but not beyond, four weeks. From 1950 normal harvesting may continue for about two months. If crowns are grown by the settler, normal harvesting will not take place until 1951.

Assuming production to be about 1½ to 2 tons an acre, and that the grower's principal market is a cannery which pays the usual rate of 5d. a pound for asparagus, this would represent a gross income of between £70 and £90 an acre a year. This amount would be considerably reduced by costs of production. It has been estimated that the average net annual return is about £40 per acre.

It is apparent, then, that asparagus growing can be most successfully carried on in conjunction with the production of other crops the harvesting of which is not necessary during the same period.

COMPOSTING

Skilful and enthusiastic propaganda has created during recent years a great deal of public enthusiasm for composting, exponents of which have claimed that, when judiciously used, it will restore fertility to soils reputed to have been "worked out," or which, through the use of inorganic fertilisers, produce crops of inferior nutritional value.

Valuable work has been done, particularly in directing the attention of home gardeners to the composting of organic substances which might otherwise be discarded or destroyed by burning.

Composting is a controversial subject, but mention of some salient points in composting organic substances may be of assistance to home gardeners who desire to have a reliable composted product for use among vegetable crops.

Making a compost heap has been defined as "a means of using to best advantage all waste material from crops grown in the garden . . . putting together certain substances so that they may decompose, the residue being applied to the garden as a fertilising agent" (see Bulletin No. 229, "Vegetable Growing in the Home Garden").

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If, as is generally advocated, all crop remains should be used in a compost heap, and some of these are affected with disease, a certain temperature must be generated within the heap to destroy the fungi or bacteria which remain on the diseased material. This heat is generated by aerobic fermentation (induced by microbes living on free oxygen derived from air). As most injurious bacteria are destroyed at a temperature of 140 degrees F., and insects, weed seeds, and fungi at 170 degrees F., it follows that the higher temperature must be reached before the composted residue of the heap can be considered free of disease and safe for application to garden soil. It has been stated by competent authorities that a temperature of 180 degrees F. maintained for 10 minutes is necessary to ensure the destruction of all injurious fungi and bacteria in soil.

Unfortunately, much so-called compost is the residue of organic substance which is not the result of aerobic putrefaction. Residues of a compost heap the organic substance of which has been mixed with diseased material and broken down by the process just referred to and in which insufficient heat, if any, has been generated cannot be free from disease, and must, when broadcast on the garden, be the means of further disease infection.

The importance of correct compost making should therefore be appreciated, and the process followed should not merely consist of piling up a heap of crop remains and other organic matter in a corner of the garden.

FRUIT AND VEGETABLE STORAGE

An announcement in the "Gardeners' Chronicle" of March 16, 1946, that "Pliofilm," a transparent wrapping material used in Great Britain during the war for packing aircraft engine parts and instruments, is shortly to be made available to the public **in a form which can be used for storing garden produce** should be of special interest to many home gardeners who may desire to store some of their surplus vegetables. It is reported that if a "Pliofilm" package is heated for a few seconds it will stretch, and the ends can be hermetically sealed. The substance is permeable to carbon dioxide and fresh garden produce enclosed in it should be preserved in fresh condition for a considerable period.

If proved to be as successful as it is claimed to be, its use will be extended to many forms of fruits and vegetables, and, because of its simplicity, it promises to supersede other methods of preserving fruits by wrapping.

GARDENERS' PROBLEMS ANSWERED

"Last year I had trouble with my **carrots splitting.** Can you tell me if there is anything I can do to prevent this with my present crop?"

[Photo News Ltd.

A simple form of composting. Every second weekend the top of the heap is sprinkled with sulphate of ammonia, a thin layer of soil is put on top, and the whole heap dusted liberally with lime. After about six months the heap is sealed with a thicker layer of soil and left to mature.

Answer: Splitting of carrots is not caused either by fungi or bacteria, although after splitting the roots may be attacked. Splitting is a non-parasitical disease, and is due to what is termed physiological disorganisation of the plant. Spring-sown crops are stated to suffer most, because early growth is generally restricted by dry conditions, and, if wet weather follows, the quick growth which takes place causes the prematurely-hardened outside skin to crack. During later development the split widens and deepens until sometimes the core becomes exposed. Roots from late-sown seed are rarely seriously affected.

"As the Minister of Agriculture has announced that potatoes from crops at present growing are not likely to be in plentiful supply, could you advise me **the best way to protect my potato crop from blight?"**

Answer: At present the best known means of protecting potatoes against the disastrous effects of late blight is by spraying the haulms with Bordeaux mixture. This spray mixture is considered more effective when the copper sulphate is mixed with hydrated lime. In districts where humid weather conditions are frequent spraying becomes a necessity. As the bottom leaves are often first affected, the disease will not be readily seen after the foliage becomes interlaced across the rows. Spraying should therefore begin as early as possible and continue every two weeks as long as it is practicable to get between the rows. For full particulars of making and applying Bordeaux mixture see pages 40 and 41, Bulletin No. 229, "Vegetable Growing in the Home Garden," obtainable from any office of the Department of Agriculture, post free, for sixpence.

"I have been advised not to use **superphosphate or sulphate of ammonia** for my garden vegetables, as they are dangerous. Can you advise me the safest manure to use?"

Answer: The terms "dangerous" and "safe" should not be considered applicable to manures or fertilisers, except in the sense that any manure or fertilising agent is "dangerous" or "safe" according to the quantity applied at any specified time.

To particular crops at all times, and to all crops at particular times, certain fertilisers may be beneficial if properly applied in appropriate quantities. This, in the language of the question, would be considered "safe"; applied otherwise the same fertiliser would be termed "dangerous."

For general purposes in a vegetable garden blood and bone manure can be recommended as the "safest" fertilising agent to use.

The moral should be plain: no manure or fertiliser can be considered "dangerous," **provided its use is properly understood.**

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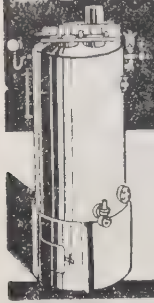

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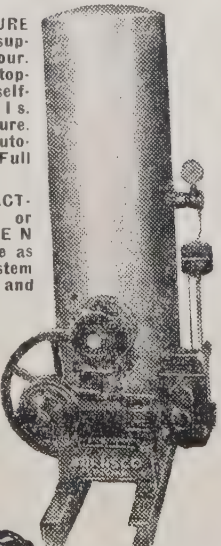

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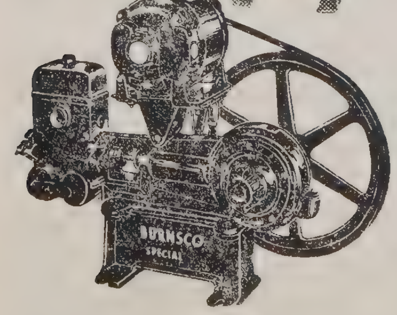

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FARM WORK FOR FEBRUARY

By the Fields Division

PASTURES

Autumn-sown Grass—Seed for autumn sowing should have been purchased by now. The purity and germination should be known before any seed is purchased. Remember that vendors of Certified seed should have certificates covering officially-drawn samples and showing the purity and germination of each line held by them for sale. Second growth which has been chopped and thoroughly dried should be fired before the autumn rains commence, and generally February is the best time to fire it. It is important to burn the material when it is thoroughly dry so that a clean burn is obtained. Sowing need not be carried out immediately after burning (although a better cover of the seed is obtained), but may be delayed, if thought advisable, till later when the autumn rains are heavier. Sowings of Italian ryegrass in the South Island for winter feed production should be continued this month. With colder soils and in colder climates autumn sowings should take place as early as possible and many advocate sowings to permanent grass in late February under such conditions. The seed-bed for autumn sowings to grass should be fine and firm.

Pasture Management — Paspalum fields that are getting out of hand should be mowed if they cannot be controlled by stock. The alternative is to close one of the fields for a late growth of hay or silage, preferably the latter in view of the chance of adverse climatic conditions at harvesting time.

Topdressing and Liming—Topdressing for autumn and winter growth of grass should be commenced this month. Fields which are intended for shutting up for winter production for early-calving cows should be topdressed early, and should contain a high percentage of ryegrass. Lime should be applied before wet conditions interfere with cartage and application.

Harvesting of Clover Seed—February is usually the month for harvesting white clover. Crops should be watched closely for their readiness for harvesting and this is indicated when the seed can be rubbed from most of the clover heads by hand. After cutting the material it is safer to stack it and leave it for a month before threshing. If the crop has been cut at a later stage or when dead ripe, it may be harvested straight away or after a short period to permit thorough drying and hardening of the seed. Extreme care should be taken throughout all operations to prevent loss of seed.

HAY AND SILAGE

Hay and silage stacks should be properly fenced off from stock. If tracks from silage pits are metalled during dry weather, a well-consolidated road with a proper camber to shed rain water can be made quite easily. If left till later when conditions become muddy, the work is much more difficult and the result is not satisfactory.

LUCERNE

The third cutting of lucerne from old stands is usually made during this month. As the weather is then usually hot and dry, the crop can be harvested with little fear of being spoiled by rain. However, the crop should be frequently turned to prevent the hot sun from bleaching and withering the leaves, which may drop off, leaving little but stalks to harvest. The leaves are the best part of the plant and therefore great care should be exercised in harvesting lucerne, particularly in hot, sunny weather. Bare patches in old stands may be cultivated and sown with red clover to prolong the useful life of the stand. Young stands of lucerne will now have recovered from the first cut and it is usually better not to make a second cut so that growth is undisturbed over the winter.

CEREAL GREENFEEDS

Surplus maize and millet greenfeed may be converted into silage, or the latter into hay. Plough vacant land for greenfeed crop sowing in March. In the South Island sow barley now for feeding during early winter onward and sow oats for winter and early spring feed, both these crops being sown at about 2 bushels to the acre. In the North Island sowings of barley or oats for greenfeed are not usually commenced till March. The land should be ploughed by now and cultivated in the next few weeks. The seed-bed should be fine and firm below and somewhat rubbly on top.

ROOT AND CRUCIFEROUS CROPS

Sowings of soft turnips in milder parts of the North Island may be made this month for provision of winter feed. Unless sown with pasture, rape areas as they are finished should be disced to cut up the stalks and to loosen the packed soil surface before ploughing for the next crop, which may be autumn-sown wheat or pasture.

POTATOES

Digging of potatoes will now be in full progress throughout the North Island. In digging potato crops, particularly in certain districts in the North Island, a watch should be kept for the potato moth, which lays its eggs in the eyes of the tubers. If the moth is about, the potatoes should be picked up immediately after digging.

CEREALS FOR GRAIN AND CHAFF

Plough this month for autumn sowings of barley and oats for grain. See that stacks of cereals are properly protected from the weather and plough a few furrows round them to protect them from fire, particularly those adjacent to railway lines.

Harvesting of cereals and peas will still be in full progress. Last month's notes briefly outlined stages for cutting cereal and pea crops.

STOCK

Now that the milk supplies are dwindling, food for pigs should be supplemented by available feeding crops such as green maize. If at all possible it is better to finish off pigs during the autumn than to winter them through as stores. As rape areas become ready for them lambs should be weaned first on to short, fresh, good-quality grass or greenfeed, if available, and then on to the rape with a run-off on grass. The rape should be carefully watched, because it is best fed at the light-blue stage, when it is more easily digested, than at the dark-green or light-green stage.

Shearing of lambs is usually carried out this month. Surplus ewes should be sold and new lines of ewes and rams purchased The tupping season commences soon in many flocks in the North Island, and breeding ewes should be flushed two weeks beforehand. If rape is not available, a change on to fresh greenfeed or young growth of grass is advisable. Dipping should take place at least two weeks before mating.

Dairy cows should receive ample supplies of succulent feed such as maize, soft turnips, millet, and silage, to make up for the dry condition of the pasture, which is common at this time of the year. To prevent taint in milk it is probably preferable to feed turnips at a young stage. The turnips should be pulled and the maize cut and carted to the stock. Such crops are too valuable to permit wasteful feeding methods. Weaned calves should rotate around the farm ahead of the milking herd.

GENERAL

During dry weather gateways, bog holes, and crossings should be filled and metalled. Such areas should be well filled so that the raised surface sheds water and does not retain it and become boggy again.

Nosema Apis Recognised as the Cause of Spring Dwindling In Bee Colonies

By T. PALMER-JONES, *Research Officer, Animal Research Station, Wallaceville.*

THE symptoms of so-called "spring dwindling"—a rapid loss of field bees in the spring, when hives should be gaining strength—are familiar to most commercial beekeepers. Hives usually recover, but occasionally die out. Examination of such hives shows apparently normal bees and brood and adequate honey and pollen. The main cause of the trouble is *Nosema apis,* a protozoan parasite which invades the bees' stomachs. This parasite has been recognised for the first time as a cause of spring dwindling in New Zealand.

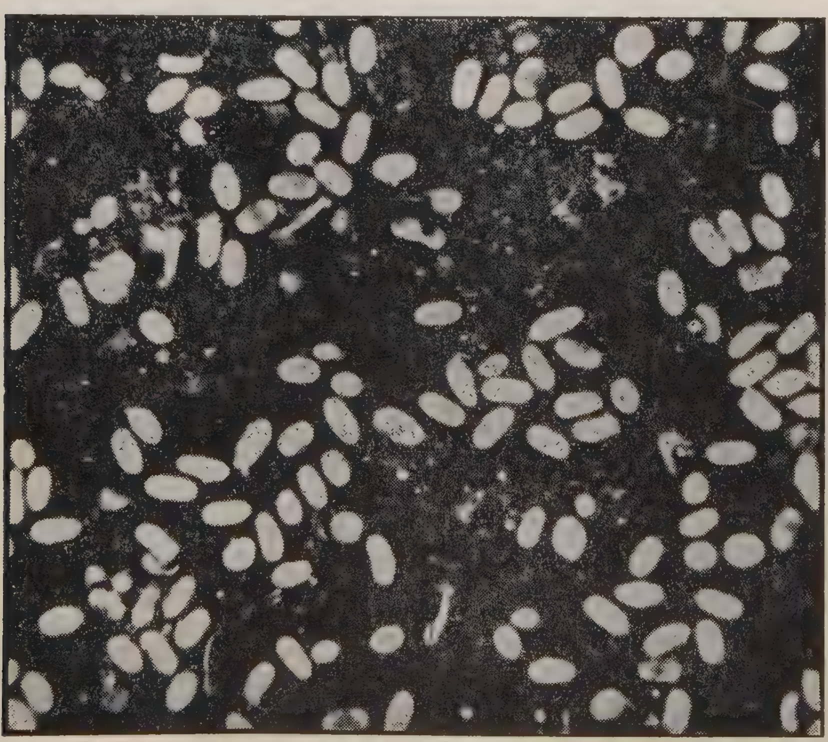
DURING the spring of 1946 adult bees from cases of spring dwindling were examined at the Animal Research Station, Wallaceville. Samples were received from Hawke's Bay, Central Otago, and Auckland areas, and the laboratory apiary was included in the survey.

In all definite cases of spring dwindling investigated the hive was found to be infected with *Nosema apis*, a parasite of which reports had not been published previously in New Zealand.

Nosema apis is a parasitic, spore-forming member of the protozoa—microscopic, single-celled animals. *Nosema* spores are more or less oval, about 2-10,000in. long and half as wide.

When spores reach the stomach of a bee they shed their coats and liberate the parasites, which enter the cells lining the stomach. There they grow and multiply rapidly, and finally produce numerous spores, which pass through the bee and can infect a fresh host.

Field bees become weakened by the enormous number of parasites in their stomachs and are unable to return to the hives when out foraging. In a badly-diseased hive all the adult bees may show some degree of infection. Queens are attacked, but brood is immune. The disease reaches its height in the spring, though it may persist throughout the year.



Spores of *Nosema apis* magnified about 750 times.

Symptoms of Infection

A loss in strength without apparent cause is usually the first sign of infection, other symptoms being difficult to detect. Microscopic examination is the only means of accurate diagnosis. If *Nosema* is suspected, a queen cage of live field bees should be despatched through the local apiary instructor to the Animal Research Station, Wallaceville, for examination.

It has been shown in America that combs and equipment from infected colonies do not spread the disease. Isolation of infected colonies is not recommended in any country where *Nosema* occurs, as the disease is not considered serious enough to warrant such action. Contamination of drinking water and the robbing of diseased hives probably cause the spread of *Nosema.*

No Cure Yet Known

Many drugs have been fed in syrup to bees in an attempt to cure *Nosema*, unfortunately without effect. Methods of treatment are being investigated at Wallaceville. If an infected colony loses its queen or is rapidly losing strength, building up with a nucleus is of value.

Nosema has been reported from Australia, Brazil, Canada, England, Germany, Switzerland, and the United States of America. Its presence in New Zealand is not surprising, as it was first reported in Australia as early as 1910. It is possible that *Nosema* was introduced in the early days of beekeeping, as it is probably the commonest and most widely distributed of bee diseases.

Nosema is a far less serious disease than American foul brood. Strong colonies with a mild infection soon throw it off and recover, as was the case at Wallaceville in some of the strongest colonies. A weak colony with a heavy infection may die out, and occasionally a group of hives, perhaps with lowered resistance, becomes a total loss. The economic loss to the beekeeping industry as a whole is probably small.

There is little doubt from past accounts of spring dwindling in New Zealand that *Nosema* has been present for many years. Its recognition as a cause of spring dwindling does not suddenly bring to light a new disease, but indicates the cause of an old one. Methods of treatment can now be tried and checked.

RECLAMATION OF TIDAL FLATS

TIDAL flats need not be useless areas abandoned to a jungle of mangroves. With suitable treatment they can be made highly productive. How it is done is clearly set out in the following article.

By **E. B. GLANVILLE,** ***Assistant Fields Superintendent, Auckland.***

THE reclaimed tidal flats of New Zealand consist, in the main, of very fertile soils. They form a wide range, varying from sand to sticky clays, and in their natural state the majority of them are covered with mangroves. For general purposes they can be classed in three broad groups—sands, sandy loams to sandy clay loams, and sandy clay loams to sticky clays.

The sands are generally found at a slightly higher level, overlying beds of pipi shells, often quite near the surface. They are very light in texture, dry out rapidly during the summer, and seldom show signs of cracking, even when thoroughly drained. The sandy loams to sandy clay loams are heavier in texture, the shell is generally further from the surface, and often they do not overlie shell beds. The soils in this group are generally found at a slightly lower level than the sands; they crack immediately after stopbanking, drain well, and can be grassed successfully two or three years after tidal water has been shut off.

The clay loams to sticky clays are found in the low-lying areas. They often overlie soft, blue clay mud, and because they are so wet and low-lying, drainage is a slower process. It generally takes from six to eight years before soils under this group can be brought to a suitable condition for grassing. These soils do not crack until they begin to dry out. The cracking after stopbanking and draining is important, as it assists to remove the excess salt from the surface soil.

Stopbanking

Before any attempt can be made to develop tidal flats it is first necessary to build stopbanks on the edge of the area to be reclaimed to prevent tide waters gaining further access. The material for building the stopbanks is obtained by digging a ditch inside the bank. The size of this ditch depends on the height to which the stopbank has to be built in order to hold tide-waters back. The ditch serves as the main outlet drain to the flood-gates for the reclaimed area. Stopbanks should be built a few feet from the edge of the ditch to prevent weight causing the sides of the ditch to slip and block this outlet drain. Stopbanks should have a batter of at least one to one, and should not be less than 2ft. above the highest known spring-tide level. The size, therefore, has to be determined by the height necessary.

Banks with a rise of 6 to 7ft. require to be 15 to 18ft. wide at the base; this will allow sufficient batter with the top of the bank 3 to 4ft. wide. The chief difficulty in getting stopbanks to stand is the erosion caused by the tide-lap on banks exposed to the direct action of a wide expanse of water. In places it is often necessary to protect the banks by facing them with stone or fascines. It is also advisable to plant suitable grasses on the banks for binding purposes. Buffalo grass is quite suitable, but is somewhat slow in covering the banks. Another grass which is used considerably for binding is kikuyu grass. It has much the same growth habit as buffalo grass, but is more aggressive, spreads faster, and is more palatable to stock. Although it does not seed, there is a decided possibility of its gradually spreading on to the flats, where it would become troublesome and make future cultivation of the land very difficult, if not impossible. Where there is a quantity of shelly material in the stopbank strawberry clover establishes well. It will grow under salty conditions, and will cover the banks, but has not the same strong-rooting system as buffalo or kikuyu grass. Taking everything into consideration, even although buffalo grass is slow in covering the banks, it is considered to be the most suitable grass for this purpose.

Flood-gates

The ditch, or main drain, which is dug to provide material for the stopbank, is provided with outlets through the stopbanks. These outlets are fitted with flood-gates to stop effectively the inflow of water from incoming tides, and to let drainage water out when the tides recede. The outlets through the stopbanks should be concreted and provided with hinged flood-gates fitted close into the concrete, so that they become water-tight with the pressure of incoming tide waters. Concrete pipes, 1 to 2ft. in diameter (or larger if required), cemented at the joints, and set in a concrete bed, are suitable for outlets through the stopbank. Wing-walls are required for about 4 to 5ft. on each side of the outlet to prevent erosion from the flow of water. A fluming is also required at the outlet for about 20ft. to carry the water into the tide, otherwise a large hole will form in the tidal side of the outlet, which ultimately will undermine the bank and cause it to slip away. Concrete flood-gates are preferable to wooden ones, as wood warps because of one side being wet and the other side dry. Flood-gates are constructed at the lowest level to provide outlets for the main drains, into which the internal drains flow, and they should be sufficient in number and size to carry drainage water away quickly between tides.

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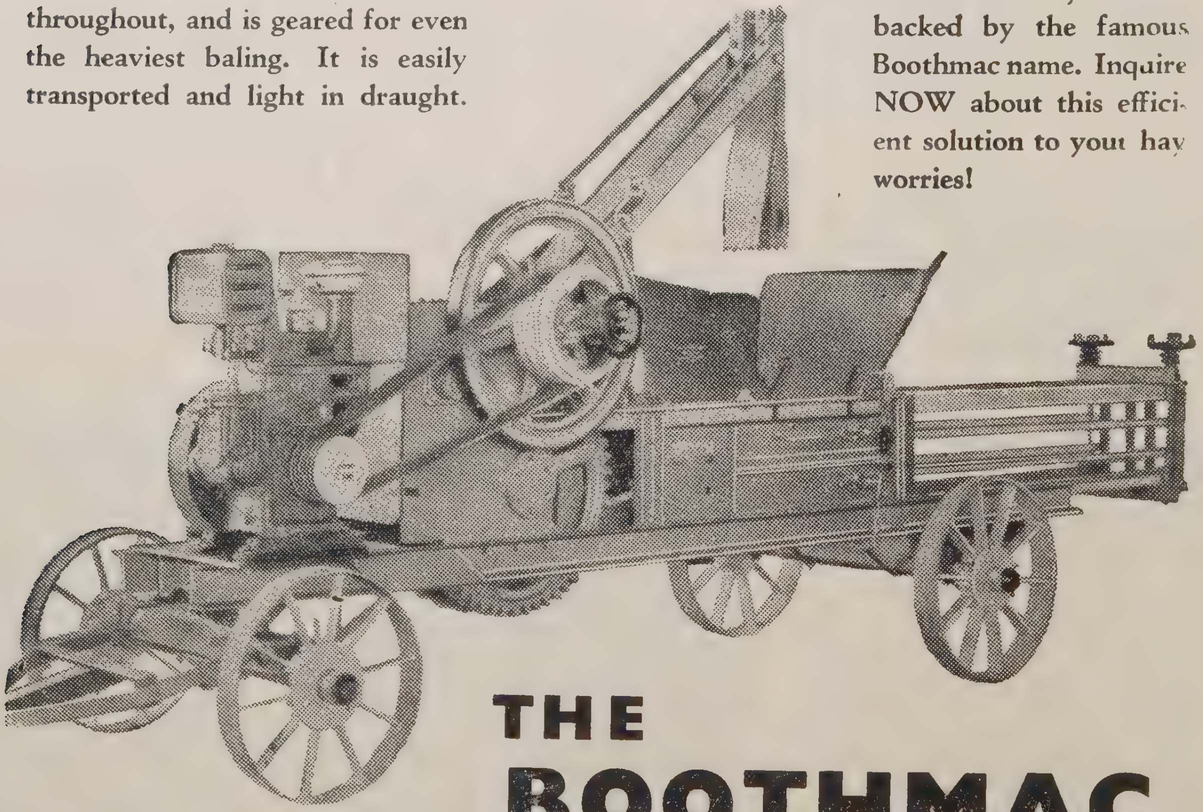

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Where the reclaimed area is almost level with the outside water at low, or partly low, tides, drainage through flood-gates is not very satisfactory. Where this occurs other means have to be used to remove drainage water collected by the internal drainage system. The only satisfactory method of removing this water is with flood-pumps. Even where flood-pumps are used, it is generally advisable to provide flood-gates, as a certain amount of drainage water will escape from the reclaimed area at low tide. This will allow more economical use of the pumps, which would be in motion only when the tide waters prevented the escape of drainage water through the flood-gates.

It is very important for the successful development of reclaimed tidal areas that provision be made for drainage water to be removed as quickly as possible. If the area is at a reasonably high level, this can be achieved by the use of flood-gates, but if all drainage water cannot escape through the flood-gates between tides, it is necessary to remove it by flood-pumps. It is imperative to have a survey taken of levels of the area to be reclaimed before work is commenced, so that data are available which will indicate whether flood-gates can be constructed at a level which will adequately allow drainage water to escape through them when the tide recedes, or whether it is necessary to install flood-pumps to lift surplus drainage water over the stopbank into the tide.

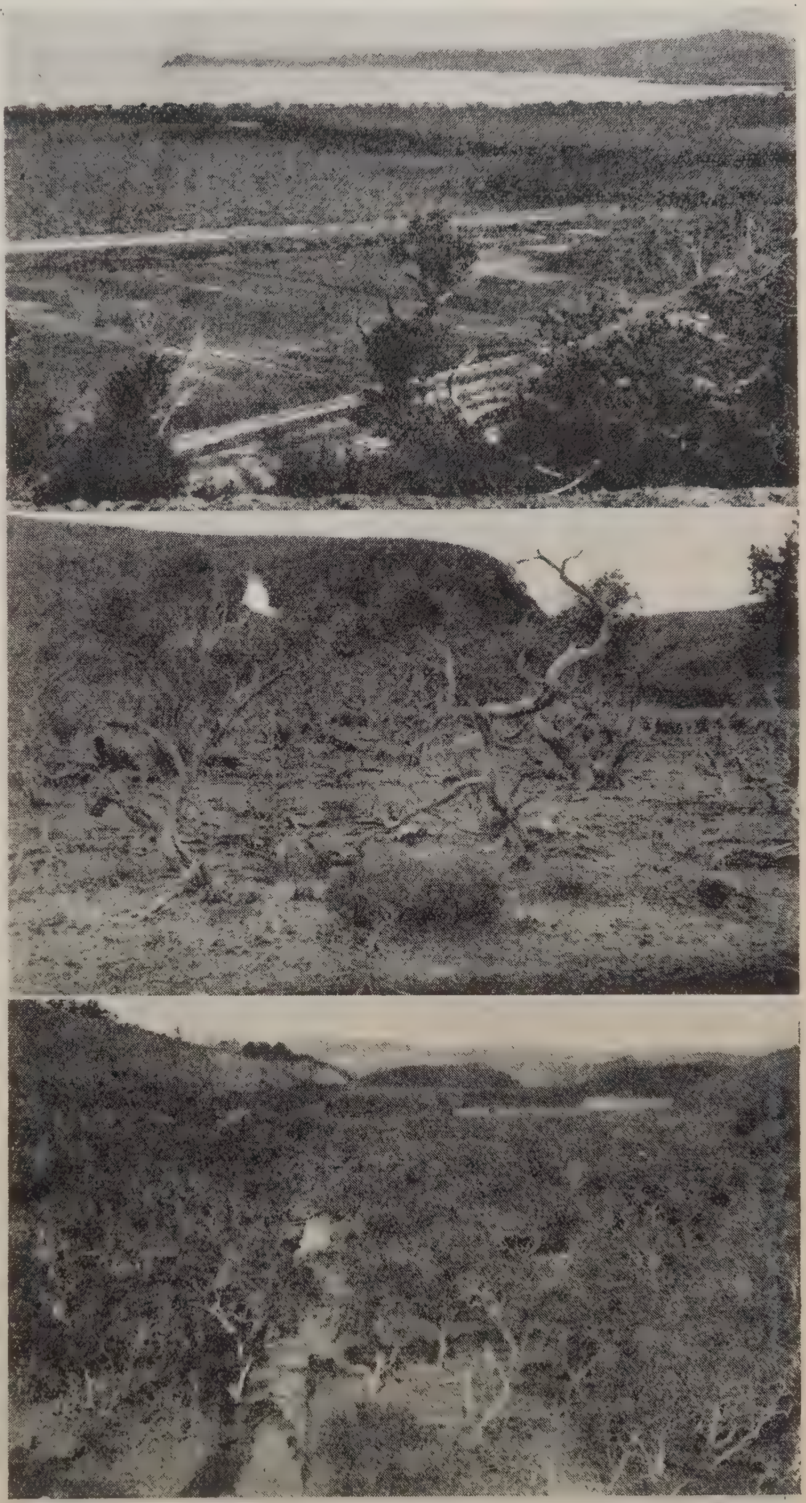
The use of flood-pumps for removing drainage water from farm lands has been dealt with previously in the "Journal of Agriculture." In the issue of September, 1935, J. E. Bell dealt fully with this subject, and an article by E. H. Arnold was published in the November, 1942, issue.

Internal Drainage

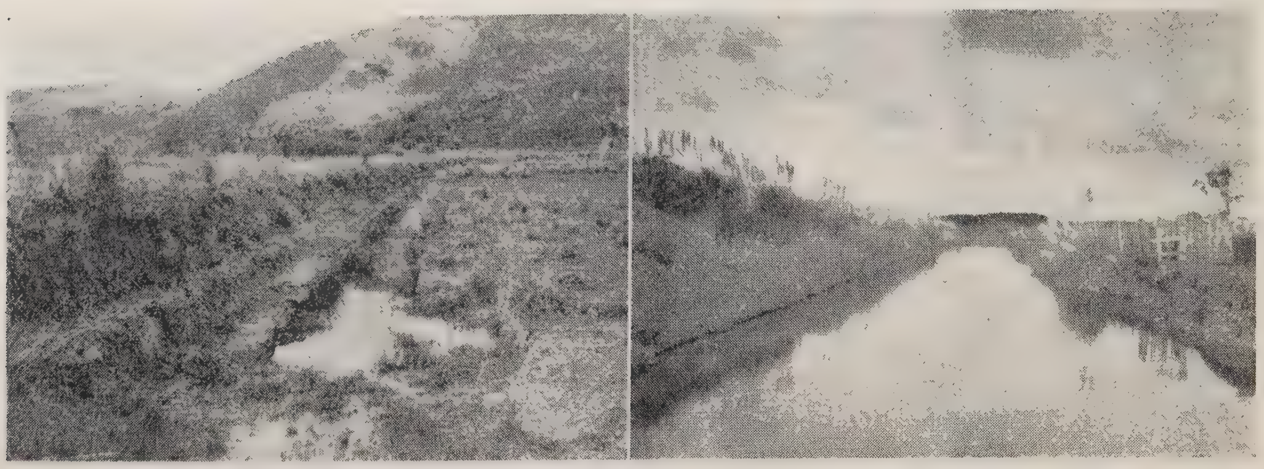
Internal drainage on reclaimed tidal areas is essential to bring the soil into a state fit for grassing.

The percentage of salt in the soil must be reduced before grasses and clovers will grow satisfactorily. This process is more rapidly achieved by thorough underground drainage. If the soil cracks freely after stopbanking, open drains every five to six chains to a depth of 2ft. 6in. to 3ft. are usually sufficient to carry off the water. In sands and sandy loams overlying shell open drains every chain to a depth of 2ft. to 2ft. 6in. will serve the purpose of eliminating salt rapidly, but the drains are much more effective if fascines are used and the drains put in two chains apart at a depth of 2ft. 6in. to 3ft. The sticky clay types are the most difficult to drain and deal with generally.

MANGROVE TREES ON TIDAL FLATS



Upper—A typical view of tidal flats, showing reclaimed area in foreground. Area outside stopbanking shows natural growth of mangroves in tidal waters. Middle—Mangrove trees dying after drainage of reclaimed area is becoming effective. Lower—Another view showing strong growth of large mangrove trees on unreclaimed area.



Left—A stopbank of considerable age showing main drain inside bank and step between edge of drain and stopbank. Note strong protective growth of buffalo grass on bank. Right—Large stopbank and drain on large reclamation. Stopbank has been constructed with material from drain by means of a grab dredge. Note protective covering of strong growth of buffalo grass and pampas grass on stopbank.

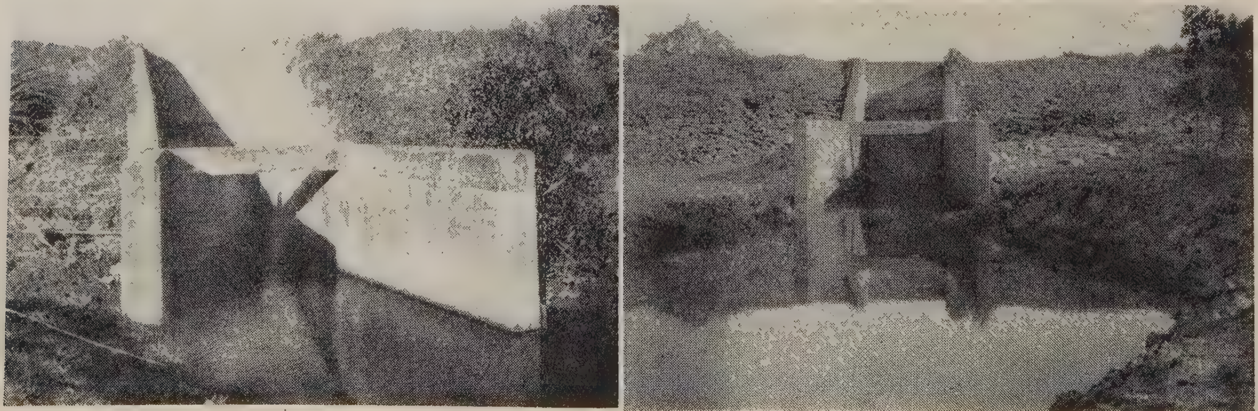
Stock should not be allowed on stopbanks. Open drains one chain apart should be put in to a depth of 2ft. 6in. and, if possible, converted to fascine drains. Rushes and sedges usually come in on these types some time before they are ready to grass. The drains should be acting well for at least two to three years before an attempt is made to sow grass.

Time Required

The period which must elapse from the time the sea-water is shut off until a reclaimed tidal area is ready to be sown successfully to permanent pasture varies considerably with the type of soil and subsoil dealt with. After years of submersion by sea-water the soil becomes saturated with salt. It may take two to ten years, or more, before the percentage of salt is reduced sufficiently for pasture grass and clovers to establish satisfactorily. While there is a large percentage of sodium salts in the soil, the clay types, particularly those with little or no shell near the surface, remain sticky. Ploughing or cultivating them too early may do a great deal of harm in rendering these types unsuitable for the growth of plants other than rushes and sedges. All types overlying shell beds are easily dealt with, and may be made ready by thorough drainage to carry permanent grass and clover within two or three years after stopbanking. Sandy loam to sandy clay loam types which crack freely after stopbanking require least drainage, and are soon ready for grass. Sands with no shell which do not crack, and sticky clay types which take a considerably longer time to drain efficiently, are the slowest to come in. A thorough internal, underground drainage system working satisfactorily is essential before any attempt can be made to prepare these types for permanent grass.

Indicator Plants

As the drainage on reclaimed tidal flats begins to take effect, and the soil becomes sweeter through the percentage of salt decreasing, two plants, known as sea aster (*Aster subulatus*) and fleabane (*Erigeron canadensis*), commence to establish. They are



Left—Large concrete flood-gate from the reclaimed side. Wing-wall necessary to protect stopbank from eroding by large volume of water held back in main outlet drain by rising tide. Well-established buffalo grass binds and protects stopbank on reclaimed or dry side. Right—Outside of same flood-gate with hinged wooden gate and strongly-constructed wing-walls. Note paving of bank with stones to protect outside of stopbank from erosion through tide lap.

known as indicator plants, and they act in the capacity of a soil chemist. When they start to come in and grow on reclaimed areas it is an indication that the soil is becoming sweeter through the salt content diminishing.

Sea aster (*Aster subulatus*) is the first indicator plant which makes its appearance. It is an annual with quite smooth stems and leaves free from hairs. The plant seldom reaches more than 3ft. in height. The lower leaves may be up to 8in. long and ¾in. wide, slightly fleshy and smooth to the touch, becoming thin when dry. The margins of the leaves may be somewhat wavy, but lack distinct teeth. The upper leaves are shorter and very narrow, widest near the bases. The branched inflorescence is more spreading and open than that of fleabane. The flower heads are purplish in the centre, and the white rays are usually more distinct than in the fleabane. Sea aster will rapidly become general over the reclaimed area as soon as the salt content of the surface soil is slightly reduced. This plant definitely indicates that the salt is commencing to go from the soil, but it is not in a fit condition to prepare for permanent pasture until fleabane (*Erigeron canadensis*) commences growth and begins to replace sea aster.

Cracking which takes place on sandy loam areas after tide water has been shut off by stopbanking. These areas are easy to drain and are in a condition for grassing 2 to 3 years after stopbanking.

Fleabane (*Erigeron canadensis*) is an annual, with erect, rather wand-like, finely-grooved, bristly-hairy stems. On good soil it may reach a height of 10ft., but on poor soil may flower when only a few inches high. When cut, it stools freely, assuming a bushy habit. The lower leaves are about 3in. long and up to ¾in. wide, the widest part being above the middle. They are rough to the touch, owing to the bristle-like hairs, and usually show several distinct, distant teeth along the margins. The upper leaves are much narrower, usually lacking teeth, and produced in abundance. The flower heads are very small and numerous, more or less clustered on branching stems from among the upper leaves. Small white rays in the flowers can be seen only on very close inspection. Fleabane is often known as horse-weed, butter-weed, fire-weed, or bitter-weed, but is generally known as fleabane. It is rejected by stock, and can be classed as a harmless weed. The leaves are bitter and the plant is objectionable if occurring in any quantity of hay. On reclaimed areas in the process of sweetening it grows on the higher parts, and does not invade the flats till the salt content has considerably decreased. As the sweetening process proceeds fleabane comes in first along the edges of drains, on drain banks and stopbanks, and gradually invades the lower areas. Fleabane does not become general until the land is well enough drained and free from salt to take grass well. When the area reclaimed reaches this stage, and fleabane has practically taken charge, preparation may commence for sowing permanent grass, but it is a mistake to make any attempts at grassing until this stage is reached.

Severe cracking which takes place on the heavy clay areas when they begin to dry out. These areas are difficult to cultivate and are not in a condition for grassing until 8 to 10 years after stopbanking and drainage by an underground system.

Cultivation

Considerable areas of reclaimed flats have been grassed satisfactorily after surface cultivation. This applies especially to soil types which come under the heading of sand and sandy loams. Even although fairly successful pasture can be established after

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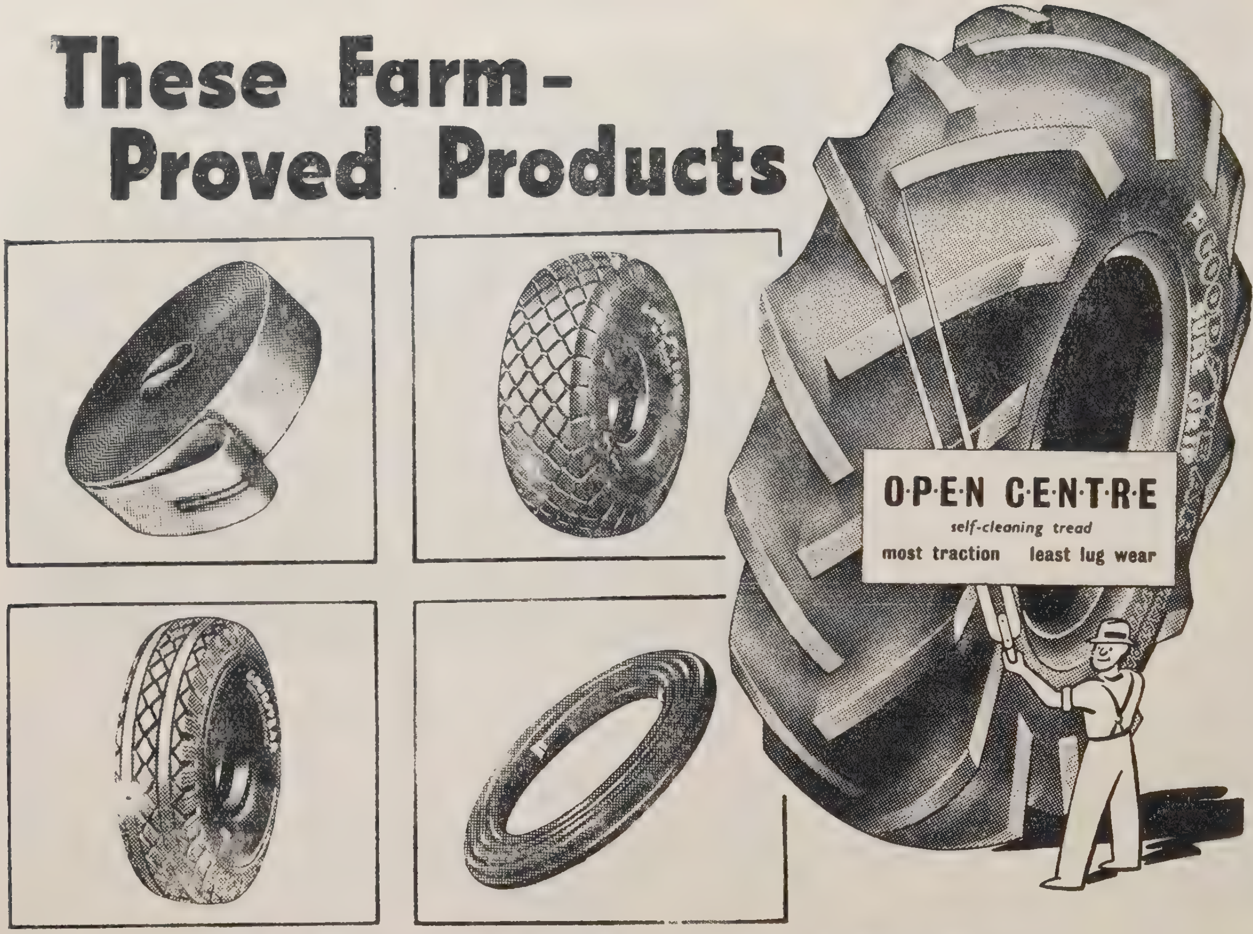

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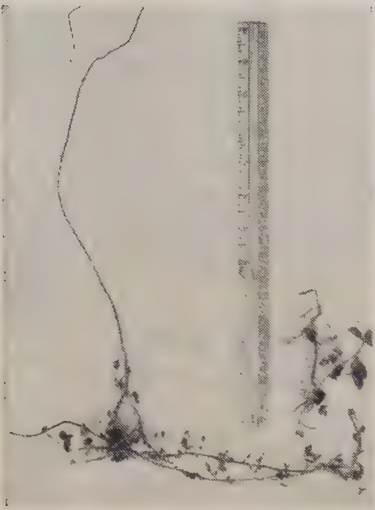
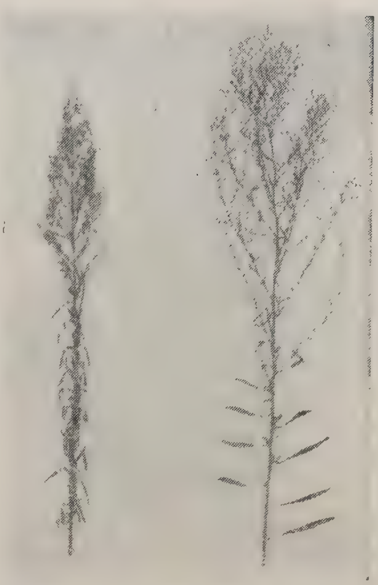


Strawberry clover, the pioneer plant for pasture establishment on reclaimed tidal flats. Left—A plant of strawberry clover. Right—A plant of white clover for comparison. Note strong, deep rooting system of strawberry clover and short roots of white clover, from the stolon.

this type of cultivation, better results are obtained after ploughing and a fallow before sowing. Ploughing should be done during the late autumn, before the land becomes wet, and the furrow slices should be broken down roughly. If the land is left in this condition through the winter, the rains will assist to wash out more salt to the lower layers or into the drainage system. It is generally not necessary to plough a second time, but the land should be constantly worked with a cultivator and penetrating harrows during the summer. This sweetens the soil considerably and allows adequate aeration while a good seed-bed is being prepared which will be consolidated from the bottom up. The seed-bed should be ready for sowing during late February, and one stroke of the Cambridge roller just prior to sowing the seed should be sufficient. Clay soil types cannot be handled satisfactorily without ploughing, on account of rushes, and they should be subjected to thorough summer cultivation before sowing to grass. It is necessary, on the clay types, to clear the mangrove trees before any progress can be made with ploughing and cultivation. If mangroves are present, they rapidly die when the sea water is shut off the area, but they entail a considerable amount of work in clearing where the trees are large. Stumping is often necessary to prepare the land for ploughing.



"Indicator" plants. Left—Inflorescence of fleabane. Right—Inflorescence of sea aster.

Grassing

Where the drainage is efficient, and the cultivation is thorough, no difficulty is experienced in establishing a high-producing sward of perennial ryegrass and clovers. Strawberry clover does well on reclaimed flats. It will establish before other types, and should be sown in all mixtures. White clover establishes soon after strawberry, but is checked considerably during the summer, when reclaimed tidal flats become very dry. Perennial ryegrass will thrive only when the clovers have made good establishment and are thriving. Paspalum, although slow to establish, does well when established, and forms a good combination with perennial ryegrass and white and strawberry clovers. Italian ryegrass, alsike, and red clover can be used, but they form only temporary elements. A mixture which has proved satisfactory on well-drained reclaimed areas consists of—

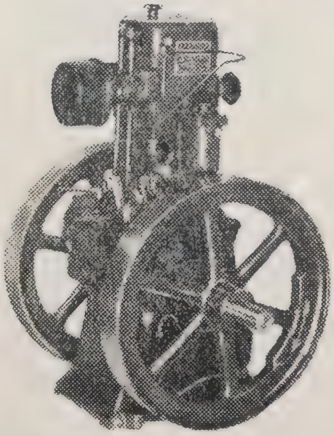
	lb. per acre.
Perennial ryegrass (Certified)	25
Paspalum (Australian)	5
White clover (Certified) ..	2
Strawberry clover	2
Red clover	3
	37

Note: Paspalum is included for North Auckland, but further south, where climatic conditions are cold, it should be deleted.

Strawberry clover (*Trifolium fragiferum*) has proved a very valuable plant for establishing pastures on re-

A farm on reclaimed tidal flats brought into permanent pasture with the aid of drainage and strawberry clover, carrying a herd of dairy cows.

FROM WAR TO PEACE . . .



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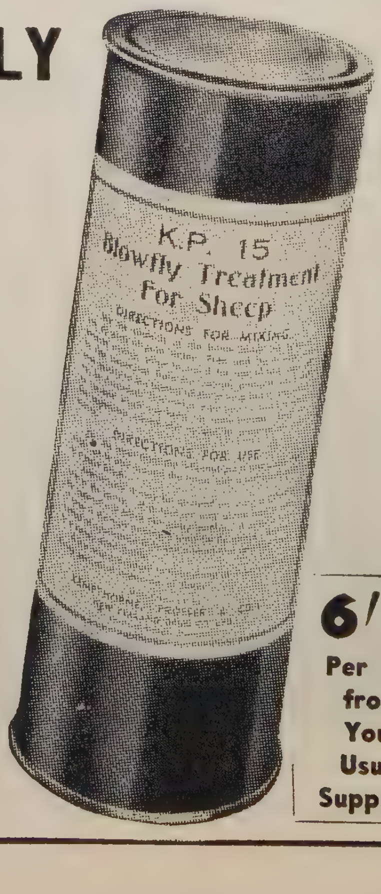

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claimed tidal flats. Without strawberry clover it is practically impossible to obtain successful pasture establishment on soils such as are found on tidal flats. It is a perennial plant, and is like white clover in its habit of growth, spreading over the ground by means of stolons. Like white clover, the stolons strike roots at the nodes, but it differs from white clover in that it has a very deep rooting system; its roots will penetrate up to 2ft. into the soil. This deep rooting system explains why strawberry clover grows so successfully and produces highly through the summer on soils such as these, which dry out so rapidly during hot summer weather.

The leaflets of strawberry clover are hairless, and similar in appearance to those of white clover, only they are a true oval, instead of being heart-shaped or narrower at the base as compared with the leaflets of white clover. The flower is very similar to the white clover flower, but the petals usually have a pinkish tinge. Later it forms a strawberry-like seed head from which it receives its name. Strawberry clover establishes best in damp situations. Although it will exist under very wet conditions, it grows best where the drainage is good. It will exist in drier, more salty, and in wetter conditions than white clover, but it demands high fertility for vigorous growth. In the winter, and in wet summers, it grows less vigorously than white clover. In dry summers, when white clover ceases to grow, strawberry clover produces abundantly. Without clover, perennial ryegrass will not thrive. A good clover establishment in laying permanent pasture is the secret of success. Strawberry clover is the pioneer plant which paves the way for other high-producing grasses to grow on a soil type where it is difficult for other clovers to establish. As strawberry clover establishes, perennial ryegrass commences to grow through it, and the pasture sward becomes a ryegrass-strawberry clover one. Such a pasture is capable of high butterfat production per acre, the ryegrass producing most of the feed in the autumn, winter, and spring, while the strawberry clover maintains production during the summer. In areas where climatic conditions are suitable for paspalum, strawberry clover greatly assists this grass to make the sward a better producing one, especially during the summer.

Fertilisers

Soils on reclaimed tidal flats are very fertile, and manurial trials conducted on them have given little information. The most promising results have been obtained from superphosphate, basic slag, and potash. When in good condition the land produces a strong growth of clover which

PASTURE ESTABLISHMENT ON RECLAIMED FLATS

Upper—Strawberry clover making strong establishment on depleted reclaimed land among a weed growth of buttercup. Middle—Strawberry clover establishing on practically bare ground. Note dead stalks of pennyroyal on the invaded territory. Lower—A side view, showing the dense sward of ryegrass and strawberry clover. Note the strong root growth of strawberry clover.

causes a considerable amount of bloat in dairy stock. Topdressing with phosphates or potash only increases this trouble by producing more clover when a response is given. It is the practice of many who are farming these areas to use a topdressing such as ammoniated superphosphate, or sulphate of ammonia, to encourage a stronger growth of ryegrass. It appears advisable to dress the land with a light dressing of phosphate at the time of sowing, and on the sticky clay soil types it would be an advantage to use, in addition to phosphate, ground limestone at 5cwt. per acre to assist the rapid establishment of strawberry and white clover. Subsequent topdressing depends entirely on the sward established. If the sward does not develop into a high-producing one without topdressing, it is necessary to build up the fertility with phosphates, and perhaps lime or potash in addition.

Crops

These soils grow good crops of mangolds, turnips, and maize, but unless a normal season is experienced, the crops are grown with difficulty. The soil is difficult to cultivate, and if wet weather is experienced, it becomes very heavy and soft. Attempts have been made to grow lucerne, but few successful stands have been established, as the winter conditions are generally too wet for the production of good crops. Maize can be grown successfully, and the grain is valuable for pig and poultry feed. With the prolific summer growth of pasture, adequate supplies of hay and silage can be saved, and farmers on these areas are inclined to rely on all-grass farming, using the hay and silage during periods of lean grass growth, rather than face the difficult cultivation necessary to produce good crops.

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Progress of Young Farmers' Clubs

THE Young Farmers' Clubs movement in New Zealand has made good progress during the past year, and its activities have spread into practically every farming district. The pre-war tally of 6,000 active members in 203 clubs has been exceeded, the present strength being 272 clubs with a membership of nearly 8,000.

THE clubs are located in the following council areas:—

Otago-Southland: 37 clubs—Western Southland 13, Eastern Southland 5, South Otago 6, Central Otago 4, Dunedin 6, North Otago 3.

Canterbury: 53 clubs—Waimate 5, Timaru 9, Mid-Canterbury 7, Christchurch 10, North Canterbury 9, Marlborough 4, Nelson 5, Westland 4.

Wellington: 89 clubs—Horowhenua 5, Manawatu 18, Wanganui 10, South Taranaki 10, Mid-Taranaki 4, North Taranaki 14, Wairarapa 7, Southern Hawke's Bay 9, Central Hawke's Bay 7, Northern Hawke's Bay 2, Poverty Bay 3.

Auckland: 93 clubs—Taumarunui 4, Te Kuiti 3, Hamilton 13, Matamata 14, Thames 7, Rotorua 1, Western Bay of Plenty 10, Eastern Bay of Plenty 9, Auckland 16, Warkworth 4, Whangarei 5, Dargaville 4, Kaitaia 3.

In addition six clubs have been formed in J-Force in Japan, with a membership exceeding 250. This evidence of the high regard in which the Y.F.C. movement is held was borne out during the war by the formation of a number of Young Farmers' Clubs in the Forces, including those in Egypt and various parts of the Middle East, a club in a prisoner-of-war camp in Italy, and 14 in the Pacific.

Past Year's Activities

Among major activities undertaken during the past year have been educational courses at various centres and a number of educational tours. An innovation has been an invitation extended by the North Taranaki District Committee to a party of 50 Otago-Southland members, who went to New Plymouth and were billeted for a fortnight among local club members; the visitors attended club meetings and other gatherings and were given every opportunity to study the farming methods of the district. A party of 25 South Canterbury members took advantage of a similar invitation from clubs in the Auckland district. These visits will no doubt be repaid next season, and it is understood that a number of other districts will be following the lead.

Debating contests have been encouraged, and the national Y.F.C. debating championship has been revived; the debating starts in the clubs, and is carried on through inter-club and inter-district competitions to council contests, the best club team in each council area being in the semi-finals for the national championship. Stock-judging competitions are being carried out in somewhat the same manner, and these will be completed in the coming autumn.

The main work of the clubs themselves has been lectures, discussions, and impromptu debates at their meetings, the conducting of field days on local farms, and visits to places of agricultural and general interest. Clubs have combined for district field days and other activities, visits to agricultural colleges, research institutes, and other places of educational interest.

The social and recreational side is being developed. Sports meetings, gymkhanas, dances, card parties, and social evenings are being held, and do much to attract new members, besides assisting with club finance.

A number of clubs has been formed in high schools and secondary schools throughout the Dominion. They are proving a valuable asset to the agricultural courses at the schools, and are becoming an important recruiting ground for the Y.F.C. movement in both islands.

The Y.F.C. movement is creating in its members a deeper interest in their calling. They are taking an alert and enlightened interest in both farming and community affairs, and are increasingly realising that farming is not just a way of gaining a living but a way of life.

Any one who would like further information about the Young Farmers' Clubs movement should communicate with the local fields officer of the Department of Agriculture, or with the Organising Secretary, N.Z. Federation of Young Farmers' Clubs, P.O. Box 3004, Wellington.

Pig Broadcasts

UNDER the auspices of District Pig Councils broadcasts will be delivered in February as under:—

Auckland—1YA, on February 19, at 7.15 p.m., "Preservation of Curd for Winter Feed Supply," by H. Preston, Supervisor, Northland District Pig Council.

Palmerston North—2ZA, on February 21, at 7 p.m., "Pigs," by L. Marsdon, Supervisor, Wellington District Pig Council.

Napier—2YH, on February 13, at 7.15 p.m., "The Value of Pigs to Orchardists," by H. Hopkins, Supervisor, Tairawhiti Pig Council.

International Institute of Agriculture

By H. C. A. WARDS, *Orchard Instructor, Hastings.*

ONE of the overseas organisations connected with agriculture with which few New Zealand producers are familiar is the International Institute of Agriculture in Rome. This organisation was founded by an international convention in 1905, with 40 signatory States. Subsequent development brought the total of adhering States to 75, which included New Zealand. This article recounts the beginnings, growth, and work of the institute. The writer had the good fortune to spend two days at the institute, where he saw evidence of the vast work carried out and was able to make a brief survey of the magnificent agricultural library.

MID-NOVEMBER in Rome can be cold, and the air was keen with a light early frost as the writer left the warmth of the Hotel Quirinale one morning in 1944. This famous hotel, well known to many thousands of "Kiwis" after it became the New Zealand Club, is one of the finest in Rome. The previous evening an appointment had been made with Professor Longobardi, an English-speaking Italian of great charm and courtesy. The route led along some of the main thoroughfares of Rome, through the Pincio Gate in the City Wall, to the Pincio Gardens—a vast park containing a sports arena, the zoological gardens, the famous Borghese Galleries, and many acres of parkland threaded with tree-lined walks and drives. Toward the outer fringe of the gardens is the International Institute of Agriculture, its imposing buildings standing on a rise amid trees and grassed slopes.

The buildings and land surrounding them comprise the Villa Umberto, this being the postal address of the institute. As the institute is international, this area enjoys extraterritorial rights and thus stood aloof from things military. The diplomatic immunity of the Villa was scrupulously observed by both sides during the war. It was stated that the only "military invasion" of the premises by Germany or the Allies was that of individual servicemen interested in seeing something of the institute and its work.

The staff continued with its work uninterruptedly during the war. The main difficulty, which could not be overcome, was that the institute was situated in an Axis country and therefore cut off by mail from Allied and some neutral countries, and some members of the staff were recalled by their Governments.

Beginnings of the Institute

Toward the end of the nineteenth century the world experienced a serious economic crisis. As is usually the case, this crisis had wide repercussions on agriculture, eventually inspiring certain people to "get together" in an endeavour to find a remedy. In 1889 an International Commission of Agriculture was set up to plan international co-operation in agriculture. Apparently little was accomplished at that stage, but at a session of the commission in Budapest in 1896 a Californian farmer, David Lubin, put forward ideas which, though seemingly impracticable at the time, finally bore results in the convention which founded the institute in 1905.

The library and economics bureau of the Institute.

Lubin, formerly a wealthy trader, embarked on a farming career, and soon found that the price realised by farmers for their produce was ruled by the world market and not by local demand. Californian wheat, for instance, was sold at Chicago quotations, which in turn were based on quotations from Liverpool. Manipulation by dishonest speculators was not uncommon, and farmers therefore could not be protected in the open market by their exclusively national crop information.

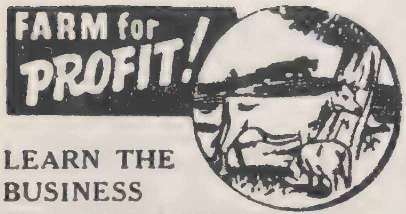
Lubin felt it was necessary to establish a disinterested service of world agricultural information so that producers, markets, and consumers could have reliable knowledge of conditions of supply and demand. He recognised that agriculture was the backbone of nations, and contended that a world-wide agricultural organisation should become the interest of all Governments.

Lubin's crusade brought him much criticism, but he remained tenacious and sure of his purpose. Nine years later, in 1905, he received considerable support from a group of Italian economists in Rome, and was invited to explain his ideas to the Italian King. Then, on the invitation of the King, an international conference was called to which many States sent representatives. The sessions began on May 28 and concluded on June 7, when a convention signed by the delegates of 40 States founded the International Institute of Agriculture, to be situated in Rome. Great Britain and Ireland were the only States of the British Empire to sign the original charter, but as time went on Australia, Canada, New Zealand, the Union of South Africa, and India all became member States. Some States, including New Zealand, have since allowed their membership to lapse.

Organisation and Finances

The States are classified in five groups, each State choosing the group it desires to join. The present grouping is as follows, these figures being a modification of the original convention as ratified in 1926:—

Group	Votes	Annual Contribution (gold francs)
1	5	64,000
2	4	32,000
3	3	10,000
4	2	8,000
5	1	4,000



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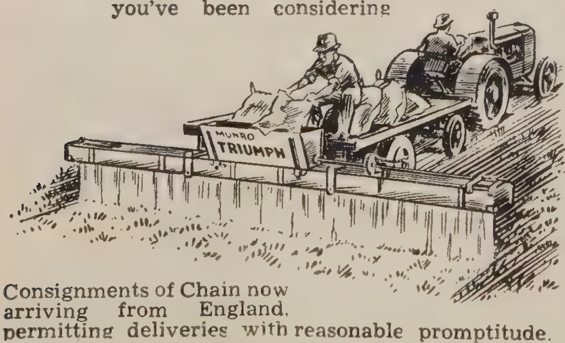

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Thus a State can vary its vote power according to the annual subscription it is prepared to pay. At the time that modification was made £1 sterling was worth approximately 25.22 gold francs. Each member State is represented in a general assembly by delegates of its own choice. The general direction of the institute is controlled by the assembly, and the executive body for implementing the work of the staff is the permanent committee. General assembly meetings are normally held each two years, but, of course, the last assembly with a reasonable representation was that of May, 1938. The permanent committee meets quarterly, with a minimum strength of 15. Each member State is entitled to one committee member, but it may be represented by a delegate from another State if it prefers.

The chief executive of the institute is the secretary-general. Under him are the secretariat, the bureaux of statistics, economic and social studies, and agricultural information, and the library. Forming part of the secretariat is the section of agricultural legislation. The secretary-general is selected by the permanent committee from applicants from all countries; he also acts as secretary of the assemblies and permanent committee. It is obvious that a man of extremely wide and varied administrative and scientific ability is required. The staff is international in character, particularly the technical members. Knowledge of at least two languages is essential, and members are recruited by international competition.

The income of the institute is made up of the annual subscriptions of member States, an annual sum of 300,000 lire granted by the King of Italy (pre-war sterling equivalent approximately £3480), interest on cash bequests and investments, proceeds from the sale of publications, and donations. The annual contribution from the Italian monarch was reserved principally for the upkeep of the Institute buildings. Whether the fact that Italy is now a republic will affect this financial aid is not known.

Definition of Aims

The aims of the institute were defined by the 1905 convention in the following terms:—

"The institute, confining its activities to the international sphere, shall:

1. Collect, examine, and publish, with the least possible delay, statistical, technical, and economic information relating to farming, crops and livestock production, trade in agricultural products, and the prices current on the different markets;
2. Communicate to persons interested all such information as soon as possible;
3. Indicate the wages paid to farm workers;
4. Record any new diseases of plants which may appear in any part of the world, showing the countries affected by such diseases, their progress and, where possible, any effective measures for their control;
5. Study questions concerning agricultural co-operation, insurance, and credit in all their forms; collect and publish all information that may be useful in the various countries for the organisation of systems of agricultural co-operation, insurance, and credit;
6. Submit, should occasion arise, for the approval of the various Governments, measures for the protection of the common interests of farmers and for the improvement of their conditions, after preliminary study of all requisite sources of information, such as resolutions passed by international or other congresses of agriculture, and of science as applied to agriculture by agricultural societies, scientific and learned bodies, etc."

It will be seen that points 1 and 2 refer mainly to the collection, collation, and dissemination of statistical information. Clause 6 represents the most important work of the institute. Under this heading there is a great deal of activity and consultation for the protection and organisation of agricultural interests, in which a number of countries collaborate. Examples of international conventions based on the initiative of the institute are the "International Convention of Rome, dated April 26, 1934, for the Standardisation of the Methods of Cheese Analysis," and the "International Convention of Rome, dated October 31, 1920, for Locust Control."

Throughout its existence the institute has adhered to the terms of its charter, though adapting its programme of work to changes in world economy. Such conditions have been the particular object of the institute's attention, from both practical and theoretical points of view.

Important Library

The institute library is one of the most important in the world. In 1940 it held more than 350,000 volumes, and books about agricultural production in all its phases continue to be added to the collection. They are well indexed, and bibliographies are compiled from time to time on various subjects, particularly those relating to research in plant diseases and pests and plant protection. Upward of 4,000 periodicals were being received annually before World War II, and these are carefully indexed and filed. While looking through this section the writer was able to refer to various New Zealand periodicals, including the "Journal of Agriculture" and similar papers. Ten New Zealand papers were received regularly.

The librarian has been trained in America under the Rockefeller Foundation, and his ability is apparent in the library arrangement. The indexing, both alphabetically and by subjects, is thorough, and a very large and well-equipped reading room is available.

Valuable Publications

A diverse range of publications is issued by the institute—annual, quarterly, and monthly bulletins, as well as miscellaneous monographs and studies. Two important annual publications are the "International Annual of Agricultural Legislation," published only in French, and containing studies of agricultural legislation of all countries, the texts of the most important laws, and a summary of all legislative measures concerning agriculture; and the "International Yearbook of Agricultural Statistics." This is the work of the bureau of statistics, and is valuable for study and comparison of data about the principal products on the world's agricultural markets. It is published in English and French, and has been described as alone justifying the existence of the institute.

Valuable monthly publications are the Bulletins of Agricultural Economics and Sociology, Monthly Crop Report and Agricultural Statistics, Agricultural Science and Practice, and Plant Protection. These are issued separately and also in one volume known as the "International Review of Agriculture."

World Agriculture Census

No doubt the largest special work carried out by the institute was "The World Agricultural Census, 1930," comprising five bound volumes in French and English. This publication contains the results of the first and so far the only world-wide agricultural census. In 1924 it was decided that such a census would materially aid the work of the institute and also result in the compilation of more comprehensive data of production than ever formerly achieved.

INTERNATIONAL INSTITUTE OF AGRICULTURE . . .

Much of the preliminary organisation was finished by 1926, in which year Dean Mann, of Cornell University, U.S.A., was partly responsible for an agreement with the Rockefeller Foundation, which granted a generous contribution toward the expenses of the work. The United States Department of Agriculture also assisted financially and put Mr. Leon Estabrook at the disposal of the institute as director of the census project. A standard form, prepared by a commission of statisticians and agricultural economists, was sent to member States for examination, and it was adopted in an amended form by the general assembly in 1928.

Mr. Estabrook then travelled from country to country to give to each Government all necessary explanations and advice and to stimulate the interest of responsible officers. Almost all countries of the world were visited, Afghanistan, Bolivia, Liberia, Paraguay, and Persia being the only sovereign States not included. In addition a few minor colonies were missed. The results of the census were ultimately published in a five-volume work.

A second world census was being planned for 1940, and much of the preliminary work had been carried out when the outbreak of war brought the scheme to a standstill. The institute hopes to carry on with the work as soon as world conditions permit.

The work of the institute will inevitably go on, and its accomplishments will be of increasing service to economists and research workers of all producing countries. In the words of Professor Longobardi: "No other organisation is quite comparable to the institute, which is non-profit-making, non-political, international, official, and scientific. The only element the institute shares in common with all other human works is its inevitable imperfection."

Taken Over by United Nations

Since this article was written advice has been received that the general assembly of the institute held its last meeting in June. With the establishment of the United Nations Food and Agriculture Organisation the undesirability of two international bodies covering the same field became apparent. At the FAO conference in Quebec in 1945 a resolution was adopted recommending that the duties and assets of the institute and the International Forestry Centre attached to it be taken over by FAO, which would also assume certain powers vested in the institute under a number of international conventions.

The general assembly unanimously adopted a resolution for winding up the institute, and appointed a liquidation commission to collaborate with FAO to this end and report to the permanent committee of the institute. This committee will remain in operation until the institute is dissolved by a formal announcement to the Governments concerned, which is expected to be made about the end of this year.

[For much of the information contained in this article the writer is indebted to Professor Longobardi, chief of the statistical bureau, and Professor Ugo Papi, secretary-general to the institute.]

◆

Army Helped Farmers Study Overseas

IN a war that so clearly showed the vital link between primary production and the armed effort it was fitting that the New Zealand Army should add to its organisation a service which gave farmers in the Armed Forces an opportunity to study agricultural subjects. While the results could not be said to have been of direct assistance to the country's war effort, it is certain that the hard work done in their spare time by farmers and intending farmers while on active service with the 2nd N.Z.E.F. will be of considerable value to the Dominion now that these men have returned to the land.

The amazing response from both forward and base units to the first notification that courses of study were available indicated the need there was for an education scheme for those men who, though serving in the Middle East and Central Mediterranean Forces, still retained their interest in civilian occupations It was unfortunate that it was as late as March, 1944, before such a scheme became operative.

Heavy Enrolments

The initial enrolments were so heavy that the small staff which then comprised the Education Rehabilitation Service of the 2nd N.Z.E.F. soon found that it could not cope with the work of marking the large number of assignments. J. A. Sutherland, B.Ag.Sc., the first instructor of agricultural subjects in the E.R.S. Correspondence School, was soon joined by others qualified for this work, and the agricultural section quickly became one of the largest in the school.

The courses were produced by the Army Educational and Welfare Service in New Zealand with the assistance of the Department of Agriculture, agricultural colleges, the Dairy Research Institute, and the Department of Scientific and Industrial Research. Each course was made up in booklet form in a size convenient for carrying in battledress pockets or pack. Other courses were later written from textbooks by the E.R.S. staff. A limited number of textbooks were also made available to advanced students. Some of the subjects covered were: Principles of Animal Production, Dairy Farming, Pig Farming, Crops and Cropping, Grasslands of N.Z., Milk, Fruit Growing, Beekeeping, Wool, Cheesemaking, and Farm Bookkeeping. Each booklet in itself was an excellent reference work for any farmer's library, and a student completing the assignments set down for a course was, if judged successful, permitted to keep the course booklet. Probably some of the booklets are consulted today by ex-servicemen who are engaged in farming.

Supplementary to these courses, an extension service sending out classified information to interested students was maintained. Suitable articles taken from the "N.Z. Journal of Agriculture" each month formed the basis of this service, which gave a steady supply of up-to-date data to those not in the position to see current issues of agricultural magazines.

High Standard of Work

The average standard of work submitted was surprisingly high. Students comprised all ranks and came from all services. The difficulties of producing written work in the field did not deter some keen students from sending in their regular quota of answers, and some went through most of the available courses by the time they were repatriated.

Though little or no practical work was possible, the theoretical ground covered by those who were keen enough to take advantage of the scheme must now be benefiting them considerably.

◆

REARING DAIRY CALVES.

The laying of a good foundation for the young animals that will later be the milking herd is of great importance. Methods of rearing calves are fully discussed in Bulletin No. 228, "Feeding and Rearing Dairy Calves," which also deals with some calf diseases and the construction of feeding bails and houses. This bulletin is available free from the Department of Agriculture at Auckland, Palmerston North, Christchurch and Dunedin.

RASPBERRY BUD MOTH

A DESCRIPTION of the life history and habits of the raspberry bud moth *(Carposina adreptella Walker)* is contained in this article by J. O. Anderson, Orchard Instructor, Masterton. Where damage may be looked for in the canes and methods of combating the pest are also described.

THE raspberry bud moth is between ¼ and ⅜in. long, and light to dark brown or grey in colour, the lighter forms showing darker spots. On each forewing are two conspicuous raised tufts.

The egg is spherical, less than half a pinhead in size, with a series of forked spines at one end. At first it is yellowish-green, changing to yellowish-gold.

On first hatching the caterpillar is a cream colour except for the dark head. When fully grown it is about ⅜in. long, the colour being variable and probably depending on the food.

Eggs are placed singly or in clusters in crevices between leaves in a bud, or sometimes on the under or upper surface of the leaves. Each female lays up to 200 eggs. At the beginning of April these hatch in five days or less; at the end of April and beginning of May the period increases to 13 to 19 days and in July to 21 days.

On emerging the young caterpillar bores into the bud on which the egg has been laid or wanders about till it finds a bud, leaf, or fruit on which to feed. Both terminal and lateral buds are attacked. Where the terminal bud of a succulent shoot is infested the caterpillar frequently tunnels for 3 or 4in. down the shoot. In the spring when plant growth is rapid the sawdust-like refuse from the borings at once indicates the presence of a caterpillar, and under such conditions it is likely that it passes its whole larval life in one shoot. In other cases the hearts of the buds, particularly the lateral ones, may be eaten out. Caterpillars found wandering on the outsides of the canes are probably migrating to fresh buds. In winter dormant buds on the canes are the only succulent parts of the plant, and at this time of the year caterpillars in all stages are found in them.

Pupation probably occurs in a silken cocoon in the soil. Length of the pupal period varies from 2 to 6 weeks, being longer in winter.

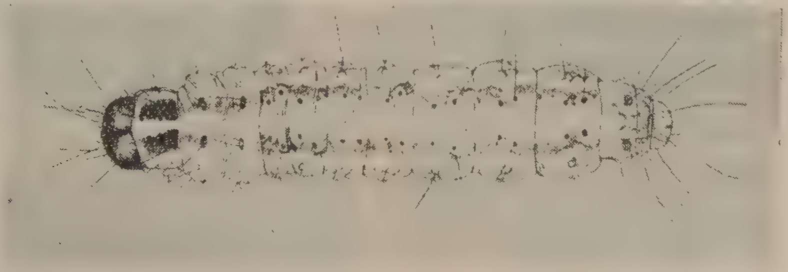
The eating of buds and the borings in the shoots are the characteristic damage done by *Carposina*, but in the autumn caterpillars have been observed to feed on the leaves of water shoots or suckers. Usually the under surface of the leaf is destroyed, and when feeding in this position caterpillars shelter beneath webbing. Damage to buds and shoots results in destruction of the growth which would bear the fruiting laterals in the current and subsequent seasons. A severe infestation may result in the canes being stunted, malformed, and fewer in number.

It is considered that a severe infestation is usually built up over years and is not caused by an influx of moth from an outside source, such as an area of neighbouring blackberry.

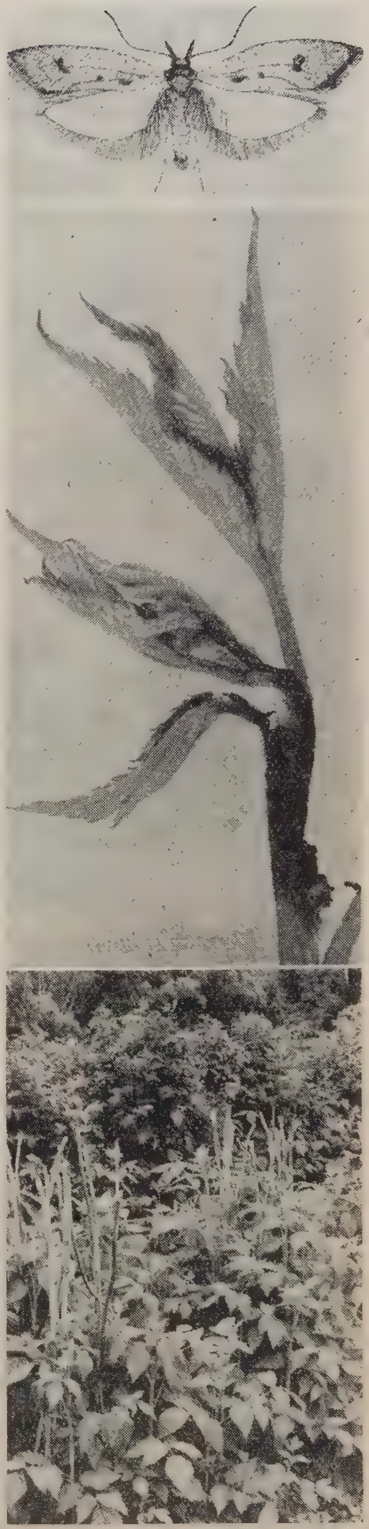
It is advisable to prune the bushes as early in the autumn as possible, as this will destroy a large number of caterpillars in the tops and remove much of the more succulent tissue on which they could continue to breed. If pruning is delayed, there is no obstacle to migration from the tops to buds on the lower canes which will be retained after pruning. All prunings should be removed and burnt with as little delay as possible.

Spray with lead arsenate (2lb. in 100 gallons of water) at green tip and again at open cluster. After the crop is harvested spray again in February and a fourth time 3 or 4 weeks later. If it is felt that a treatment is required when the fruit has set, a derris dust or spray may be used.

The data on life history is taken from an article on this insect by Miss F. J. Jeffreys in the New Zealand Journal of Science and Technology, Volume 21A (1939), pages 114A-125A.



Caterpillar of the raspberry bud moth (approximately 12 times natural size).



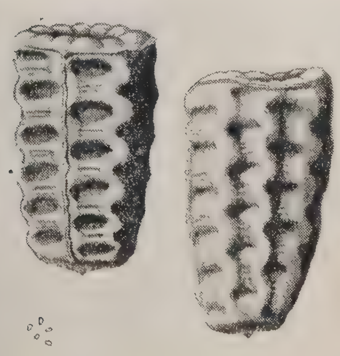
Top: An adult raspberry bud moth (approximately three times natural size). Centre: A raspberry shoot damaged by caterpillars of the moth. Bottom: Raspberry canes devoid of foliage because of the killing of buds by the caterpillar.

Weed Seeds In Agricultural Seed

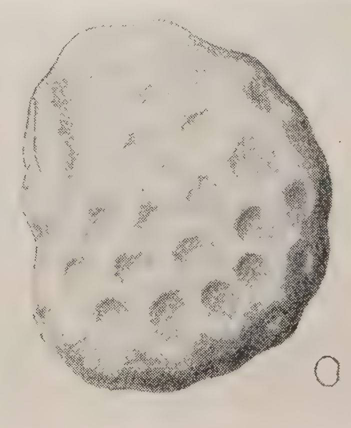
(Ninth Series.)

By
E. O. C. HYDE,
Seed Analyst, Seed-testing Station,
Palmerston North.

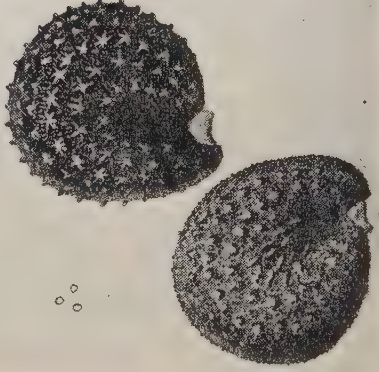
The preceding eight series of illustrated weed seeds appeared in the January, May, June, July, August, October, and November, 1945, and January, 1946, issues of the "Journal."



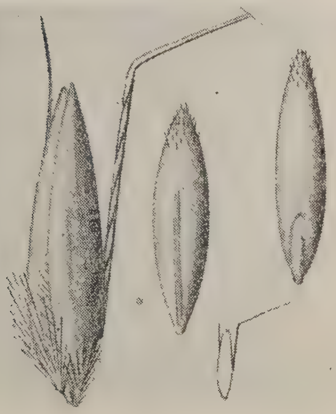
VERBASCUM THAPSUS: WOOLLY MULLEIN. Flannel leaf. Colour brown. Occurs rarely in danthonia, suckling clover, and white clover. Australia admits not more than 100 seeds an ounce. A biennial weed of pastures on light dry land.



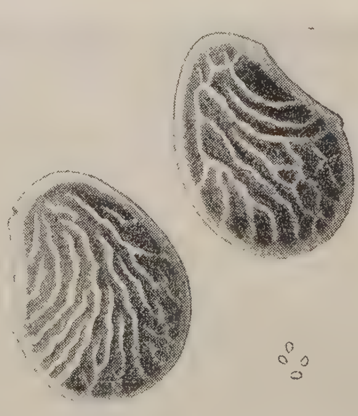
DATURA STRAMONIUM: THORN APPLE. Colour grey. Occurs rarely in imported oats and barley. A prohibited weed seed in Australia. A poisonous annual weed of cultivated land, but not troublesome in this country.



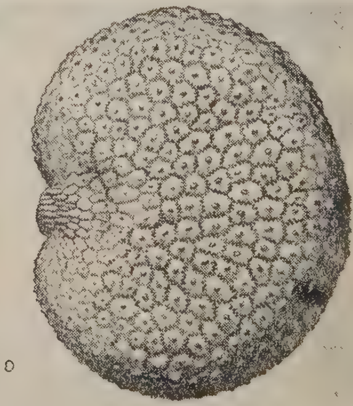
PORTULACA OLERACEA: PURSLANE. Colour black; surface markings variable. Occurs rarely in white clover and suckling clover. Australia admits not more than 100 seeds an ounce. An annual weed usually found in warm dry situations.



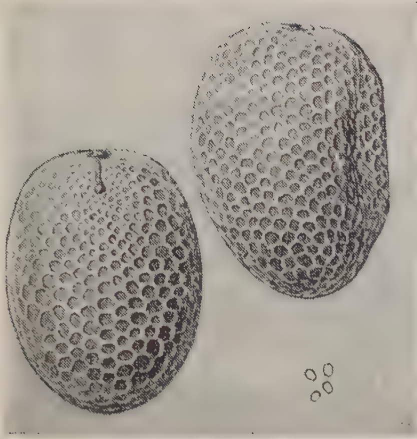
ARRHENATHERUM ELATIUS: TALL OAT GRASS. Straw coloured. Occurs with medium frequency in cocksfoot seed. It is not classed as a weed seed in Australia, Canada, or the United States of America. A perennial grass with short, thick underground stems which make it rather difficult to eradicate.



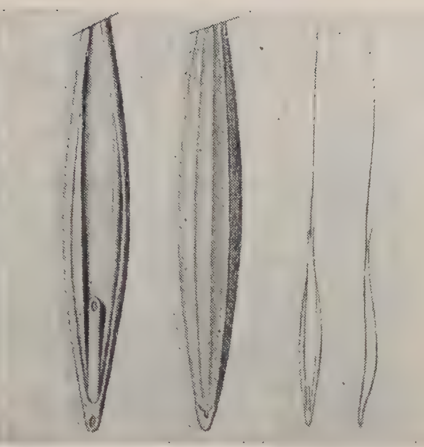
POTENTILLA RECTA: TALL CINQUEFOIL. Colour dark brown, with the ridges of a lighter shade. Occurs frequently in timothy, and rarely in white clover and *Lotus major*. A perennial weed of pastures, not common in this country.



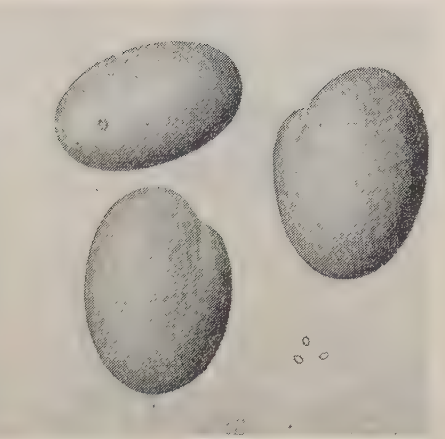
MELANDRIUM NOCTIFLORUM (Silene noctiflora): NIGHT FLOWERING CATCHFLY. Colour grey. Occurs infrequently in red clover and white clover, but frequently in imported alsike. Classed as a secondary noxious weed seed in Canada. An annual weed widely distributed but seldom abundant.



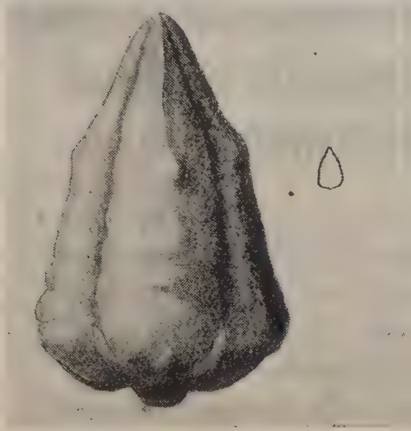
GERANIUM DISSECTUM: CUT-LEAVED GERANIUM. Colour grey or brown. Occurs frequently in red clover and lucerne. A perennial weed common in both pastures and cultivated land.



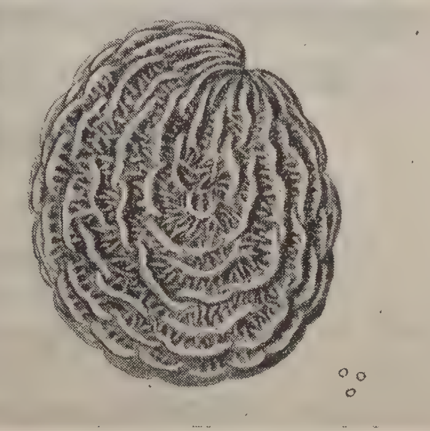
BROMUS STERILIS: BARREN BROME. Colour light brown. Occurs frequently in danthonia and occasionally in cocksfoot. An annual grass found in dry pastures.



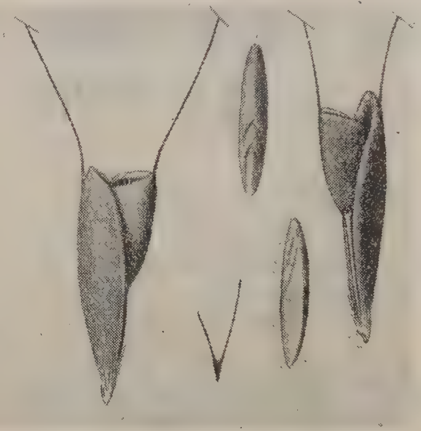
TRIFOLIUM ARVENSE: HARESFOOT TREFOIL. Colour pale green. Occurs with medium frequency in white clover and suckling clover. An annual clover often abundant on extremely light dry land.



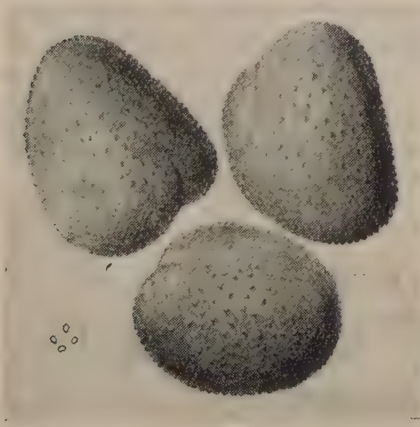
FAGOPYRUM TARTARICUM: TARTARY BUCKWHEAT. Colour brown. Occurs rarely in imported cereals. An annual weed which has not become established in this country.



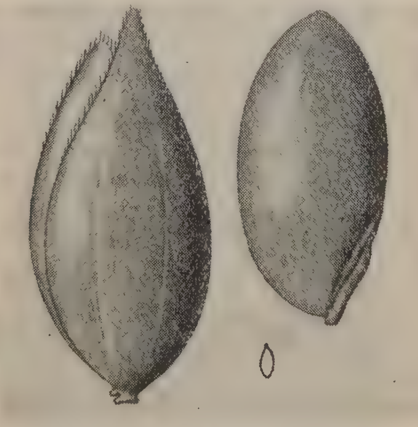
STELLARIA GRAMINEA: LESSER STITCHWORT. Colour brown to black. Occurs with medium frequency in white clover and *Lotus major*. A perennial weed of moist pasture land.



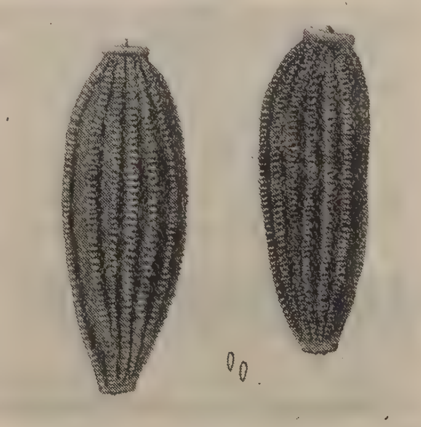
CHLORIS TRUNCATA: STAR GRASS. Husks black, grain amber coloured and translucent. Occurs with medium frequency in paspalum. An Australian grass which has not become established in this country.



TRIFOLIUM GLOMERATUM: CLUSTERED or CLUSTER CLOVER. Colour light yellow to reddish brown. Occurs frequently in white clover, from which it may be distinguished by its slightly smaller size and its rough surface. Classed as a weed seed in Canada but not in Australia or the United States of America. An annual clover of some value as a pasture plant on very dry land, but decidedly a weed where it competes with white clover.



PHALARIS CANARIENSIS: CANARY GRASS. Straw coloured. Occurs infrequently in cocksfoot, ryegrass, red clover, and cereals. Classed as a weed seed in Canada and the United States of America. An annual grass widely distributed but rarely abundant. The seed is used for feeding cage birds.



SONCHUS ARVENSIS: CREEPING SOWTHISTLE; CORN SOWTHISTLE; PERENNIAL SOWTHISTLE. Colour dark brown. Occurs rarely in cocksfoot. Classed as a prohibited weed seed in Australia, a noxious weed seed in the United States of America, and a primary noxious weed seed in Canada. A perennial plant with spreading underground stems. A troublesome weed in cultivated land.

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FARM DRAINAGE

By N. LAMONT, *Assistant Irrigation Officer, Christchurch.*

IN districts of moderate to high rainfall no other farm operation is of such fundamental importance as soil drainage, which, if inadequate, will limit the success of almost all farm work. Pedigree seeds and pedigree stock will not thrive nor will the best of fertilisers be effective if, for substantial periods of the year, the soil is cold and soggy with surplus water.

IT is significant that as soon as settled farming evolved from primitive nomadic methods attention was at once directed to drainage. In the ancient Greek and Roman Empires use was made of stone, fascine, and tile drains. In England and Europe development in drainage practices was slow until about the seventeenth century, but since then the subject has occupied a prominent place in agricultural literature.

The earliest types of drains used were fascines, or a variety of tiles, and, although mole drainage was in use about 100 years ago, it did not become popular until very recently, when the introduction of traction engines and tractors provided farmers with a source of power to do the work efficiently. In New Zealand in the early days an abundance of almost costless timber made box drains popular, but their use steadily declined as timber supplies became more scarce and tile manufacturing developed.

Basic Principles

The simple object of drainage is to remove excess water from the topsoil within a few hours of rain. Soil in structure is somewhat similar to a sponge with large and small pore spaces. The smaller pore spaces retain moisture by the force of capillarity—in the same way as blotting paper absorbs water—but the larger spaces in the soil allow water to pass through under the influence of gravity. This proportion of the total water in a soil—the "gravitational" water—is of no use to a plant, its presence in fact being detrimental. Consequently, this is the water that must be removed by drainage. No amount of drainage or over-drainage will remove the "capillary" water from which the plant roots draw their supplies; this is lost only through the plant's circulation system of the soil and through absorption by the plant roots, whence it is carried through the plant's circulation system and passed out through the leaves by the normal process of tranpiration.

Light-textured or sandy soils have a high proportion of large pore spaces and, providing that an outlet exists, will permit gravitational water to escape quickly after rain. In close-textured clay soils the pore spaces are usually small and the natural soil channels are inadequate for the escape of surplus water before further rainfall again saturates the soil. Generally, a soil can be considered to be adequately drained if the surface is firm and free from sogginess within 24 hours of a normally heavy winter rain.

Sometimes poor drainage of an area of ground may be the result of a clearly-defined source of water coming from a spring or from neighbouring higher ground, and may be corrected by placing an intercepting drain to cut off the source of the excess water. More often saturation is caused by the inability of the natural soil and subsoil channels to carry away the rainfall falling on the surface. The ground water level—the water-table—is built up by winter rains until it very frequently coincides with the general surface level of the soil. The object of drainage is to maintain this water-table at a low level by providing escape channels and so prevent it from building up close to the soil surface. Generally during dry summer weather the water-table falls below the level of artificial drains and these drains will not commence to function in the autumn until sufficient rain has fallen to build up the water-table level to that of the drains. There is only one primary force that causes movement of free water in soils and that is the force of gravity which, of course, draws the water vertically downward. Horizontal movement takes place only when, under the influence of gravity, sideways movement becomes necessary to adjust water levels in the soil. The function of a drain is to fix the maximum height of the water-table level at the point of horizontal movement, so that if it is built up by heavy rain above drain level in the soil between the drains, the "gravity head" so established forces the water to move sideways to the drain, where it has a free outlet. The extent and speed of this horizontal movement depend on the difference created in the water level—that is, on the depth of the drain—and on the resistance of the soil to the passage of the water, which is, of course, much greater in clay soils than in sandy ones.

A slab drain made by cutting a narrow channel in the bottom of a drain and placing a wooden slab across the shoulders.

Benefits of Drainage

Plant roots will not penetrate into soil that is saturated, and restricted root development means restricted leaf production. Also, a high spring water-table, by confining root development to the upper soil layers, will render the plant more susceptible to drought later in the season.

A healthy soil needs air as well as moisture. In particular, bacteria and other soil organisms responsible for the production of available nitrogen for plant food must have air if they are to function effectively and that is why one of the first symptoms of inadequate drainage is a yellow, stunted appearance of plants.

A drowned soil will rapidly deteriorate both in fertility and in its physical condition. In extreme cases substances poisonous to plants will be produced until eventually nothing will grow but weeds tolerant of these conditions. All farmers are familiar with the problems of cultivation of a soil that has been water-logged and with the practical impossibility of working down such soils to a sweet tilth. On the other hand, the texture of even a heavy soil improves after draining and a healthy "crumby" texture is developed, thereby permitting not only earlier cultivation in the spring, but a much more satisfactory seed-bed with less expenditure of labour and time, and giving higher yields of healthier crops.

All are familiar, too, with the cooling effect of evaporating moisture. A wet soil is cold, even though air temperatures may be warm, and consequently badly-drained soils are always backward in the spring until the surplus water has been removed

Another type of slab drain popular in the early days of abundant timber supplies.

by evaporation. The sun raises the temperature of a well-drained soil quickly in the spring, and the passage of warm spring rains through free-draining ground warms the soil and draws behind it warm, fresh air to stimulate plant growth and soil health.

A healthy, well-drained soil means healthy stock, indirectly through increased pasture production, and directly in its effect on the health of animals, who do not have to live and sleep on waterlogged soil. Pedigree stock, pedigree seeds, rotational grazing, and topdressing all depend for complete exploitation on thorough soil drainage.

Depths and Distances

The ideal depth of drains is one which will permanently maintain the water-table low enough to permit plant roots to develop to their fullest extent, and will also operate at a depth beyond that dried out in the summer. In deep silty soils roots of ordinary crop and pasture plants may penetrate more than 4ft., but where a stiff clay subsoil is found about 12in. or so below the surface it is unlikely that roots will penetrate far, even if it is well drained.

In deciding the depth at which to place drains it is necessary to consider the following points:—

(a) **Outlets:** It is possible to drain only to a depth permitted by the depth of the watercourses or streams into which the drainage outlets are to be led. Modern developments in drainage pumps and the usually very cheap operating costs of electric motors occasionally permit farmers to create an artificially low outlet. Frequently a potentially-rich pocket of ground is virtually unproductive through the absence of a natural drainage outlet and a pumping scheme could be readily installed. Farmers who have areas of such land would be well advised to explore the possibilities of pump drainage; they would be surprised at the low cost of handling large volumes of water through the low lifts generally required.

(b) **Protection:** The drains must be deep enough to be safe from damage by stock or implements.

(c) **Power:** In the case of mole drains the power available must be considered.

(d) **Soil type:** In deep silty soils drains may be 3 or 4ft. deep. Theoretically, even deeper drains could be installed and still be efficient at greater distances apart, but the extra cost of digging such drains would probably not compensate for the saving in tiles. Where there is a well-defined, impermeable clay subsoil, 27in. to 3ft. is the usual depth for tiles, or 18in. to 2ft. for mole channels.

The distance between parallel drains depends on depth and soil type. In free-draining soils drains may be effective if the distance apart is 15 to 20 times the depth—that is nearly a chain apart for drains three or more feet deep—but in heavy soils the distance apart may be only 4 to 6 times the depth, say 6ft. to 8ft. apart for drains 18in. deep.

In practice drains are probably more often made too shallow than too deep. It is true that soil texture improves and becomes more porous as the result of draining, and drains that seem a little too deep and a little too far apart in the first season or two may prove completely satisfactory after a few years.

Various Types

A variety of materials has been used successfully for providing a channel for drainage water. In most cases, however, the labour cost in opening and closing drains is one of the biggest items of expense, and it is sound economy to employ permanent materials underground. On the other hand, the high transport cost of tiles or the need of only a temporary drain justifies the use of less satisfactory materials.

(a) **Surface and Open Drains:** Occasionally one sees an area ploughed in narrow lands, with or without an extra furrow turned in the hollows, the practice being described as surface drainage. Although it has the advantage perhaps of preventing pools of water from accumulating, it can hardly be called drainage, as it confers few, if any, of the benefits to soil and stock that result from proper draining, since the soil is still saturated to the surface. Open drains serve a useful purpose as main drains alongside fences and as temporary measures during development. In peat swamps open drains must be used, as there is no solid bottom for tiles, and in any case progressive deepening will be necessary as the peat consolidates. As a general rule, however, their use is limited, and to permit the passage of cultivators and topdressing implements some form of closed channel is necessary.

(b) **Fascine or Brush:** This method has been employed for centuries, and when properly used is very successful. Fairly strong scrub is preferred, and it should be laid so that the butts of one bundle are covered by the brush of the next. Some difference of opinion exists as to whether the butts should point up or down the slope of the drain. It is argued by some that the ends of the stocks obstruct the flow if pointing up the slope, but on the other hand the side branches ought to be equally obstructive if the ends point down the slope. This does not seem to be a vital point, and good results may be obtained either way. It is generally advisable to tile or box 3 or 4yds. at the outlet of a fascine drain, as the material exposed to the air tends to rot quickly.

(c) **Tiles:** The most popular of covered drains is undoubtedly the tile drain and this will prove the most efficient on most soil types. The relatively high cost of tile drains must prevent their use on sticky clay soils where they would have to be very close together, and it is arguable whether

A cross-section of a fascine drain.

A cross-section of a well-finished pipe drain. The bottom of the drain was little wider than the tile, and movement is consequently impossible.

even a long-term view would justify their use. In some clay soils after, say, 15 to 20 years tiles appear to become sealed by gradual deposits of clay in the joints, so that in addition to being very much cheaper mole drains would seem to be the more efficient under such conditions.

(d) **Mole Draining:** Where there is a stiff clay subsoil, free from iron pan or other obstructions, and with a fairly even ground surface and a natural fall, mole draining can be employed satisfactorily. It is by far the cheapest method of draining and under suitable conditions is probably the most efficient.

The life of mole drains depends on the suitability of the soil type and on the efficiency with which the work is carried out. Under good conditions individual mole drains can last more than 20 years, but a mole drain system would probably need to be renewed about every 10 years to ensure effectiveness. As its cost may be only about one-twentieth of the cost of a tile system on heavy clay ground the use of the mole drain method is fully justified. A full account of mole drainage methods, including the McLeod method, has already been given in "The N.Z. Journal of Agriculture," of April, 1945, and all who contemplate draining a clay soil should give first consideration to the possibilities of mole drainage. The suitability of a subsoil for mole drainage can be judged reasonably well by moulding a piece in the hand; the plasticity will indicate whether a mole drain will be likely to stand. It will often be found that there is one layer of a clay soil, probably about 20in. deep, which may be more plastic than layers above or below it; if possible, mole plough depth should be adjusted to ensure that channels are placed in this layer.

Planning a Scheme

The first step to be taken after deciding to drain an area is to locate suitable places for outlets. The following points should be borne in mind:—

1. Outlets are generally but not always at the lowest points in a paddock. If these low points are likely to be flooded even temporarily, it is better to leave a small area undrained than risk the success of the whole project.

2. Outlets should be placed so that they can serve any expansion of the original drainage scheme.

3. They should be placed where there is minimum risk of blockage by stock or other causes.

4. It is possible to give more care to the protection of outlets and to their regular inspection during wet weather if the number is kept to a minimum.

When the position of outlets is decided the whole scheme should be planned completely before the work is commenced. With carefully-selected outlets, it is possible to plan the mains, sub-mains (if necessary), and the subsidiary drains efficiently and economically.

It is highly important also to prepare a reasonably-accurate plan of all drains, particularly tiles, laid on a property. It is quite impossible to rely on memory. The man who prepares an accurate plan will be amply repaid in time and money saved when repairs or extensions become necessary.

Should there be the slightest doubt as to the amount of fall available, some form of level should be employed. If a surveyor's instrument can be obtained so much the better, but if not, a satisfactory substitute must be devised; never rely on guessing.

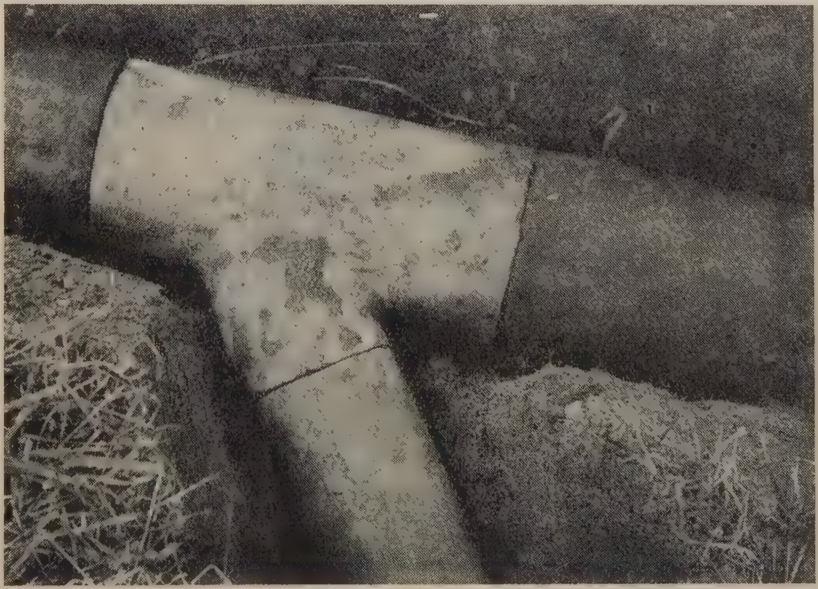
Construction Methods

A drainage system may consist of one or a combination of the different types of drains listed in the foregoing. Probably the most popular are the "all-tile" systems and the mole drain systems with varying numbers of tiles for mains and outlets.

Tile Drain Systems

Except for clay soils suited to mole draining, there is no more efficient method of draining than by the modern, cylindrical tile or pipe. Providing the job is well done, the drains are more or less permanent, and they confer immeasurable and cumulative benefits on soil, plants, and livestock.

It is recorded that many years ago in America the neighbours of a certain farmer became very alarmed because they noticed that he dug clay from one part of his farm, and after moulding and baking it carefully buried it again. Despite suggestions that he be put under restraint, this pioneer of tile draining required only a very few years to establish both his sanity and the benefits to be derived from efficient tile draining.



Subsidiary drains should enter main drains at an acute angle and properly-made junction tiles should be used.

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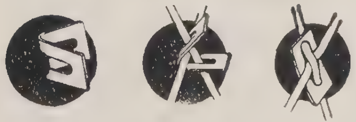

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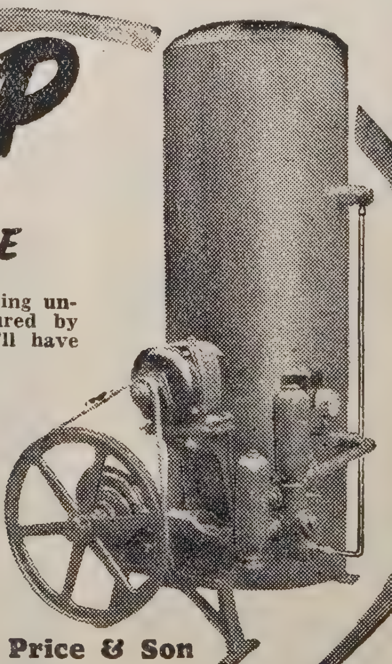

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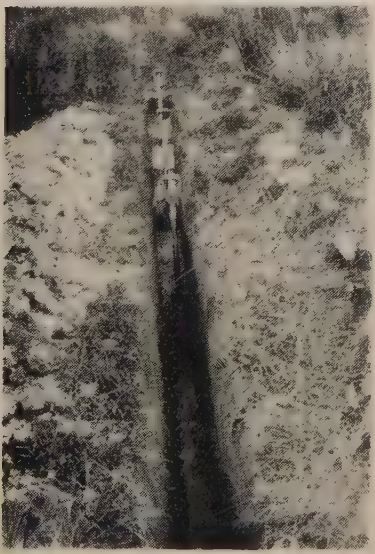
General Layout

It is impossible to give detailed suggestions that will fit every case and each paddock requires separate consideration. Having selected the position of the main outlets, it will usually be found that the mains and sub-mains will be placed along natural depressions and hollows in the paddock or along the lowest side on flat, sloping country. As the mains and sub-mains are only carriers of water, the ground on each side of them being already drained by the subsidiary drains, it is sound economy to reduce their number to a minimum.

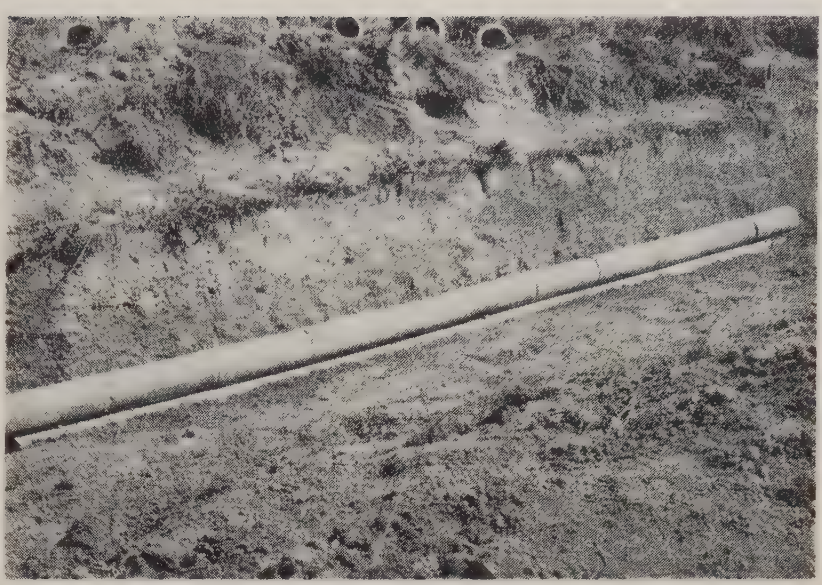
All drains and mains, particularly should be as straight as possible Sudden angles must be avoided. Right-angle junctions between subsidiary drains and the mains are also undesirable, and the former should be placed so that two do not enter the main exactly opposite each other.

Even in fairly heavy soils tile drains should have at least 2ft. clearance above them—that is, the drains should be 27 to 30in. deep and in freer soils they may be as deep as 4ft. The width apart depends partly on soil type and and partly on depth. In heavy silt soils, with drains 3 to 4ft. deep, they may be a chain to a chain and a half apart, but on heavy soils drains every half-chain may be necessary.

As the permeability of soils improves after 3 or 5 years' draining, the drains will gradually become effective over a wider area. If possible, each farmer should carry out some experiments to determine the depth and distance apart that are efficient for drains under his own conditions. One or two drains can be laid in a paddock and their performance observed over two years or so before an expensive, large-scale project is installed.



An ordinary spade leaves the bottom of the drain too wide and displacements will follow. The last spit should be removed with a draining spade and the bottom cleaned with a draining scoop.



Where the tiles have to be laid over a soft area a board may be placed underneath to prevent subsidence.

Capacity of Drains

The capacity of a drain depends on the fall and diameter of the pipe. Very little fall will suffice in a well-laid pipe drain. Probably as little as 1 in 1,000 would be efficient. One in 300 is a fair gradient at which to aim. In most cases the contour of the country will decide the matter. It is very important to avoid a loss of fall in the length of a drain, as this will inevitably lead to silting up, but a slight increase in fall is, of course, quite permissible.

It is found in practice that tiles less than 2½ to 3in. in diameter are undesirable on account of the risk of displacement and blockage. Pipes of this size are large enough for all purposes except mains. As a rough guide, it is generally estimated that a pipe of 3in. diameter will carry all the water from 10 to 15 acres, a 4in. pipe will suffice for 15 to 20 acres, and so on. Although very approximate, this rule can be applied to drains of known length and distance apart, and to mains receiving the discharge from subsidiary drains tapping a known area. Tiles more than 6in. in diameter will rarely be required, and it should be remembered that by doubling the diameter of a pipe its capacity is increased four times.

Opening and Laying

Draining is generally carried out during the winter, partly because at this season a farmer is most likely to have time to attend to such work, and partly because it is easier to get a clean-bottomed trench under damp conditions. Furthermore, a small amount of water in a drain is a useful guide in obtaining an evenly-graded bottom.

It is not advisable to open more drain than can be conveniently finished in a short time, or to dig the whole system partly and leave the cleaning of the bottom until the tiles can be laid without delay, otherwise weathering or scouring can cause a good deal of trouble.

It will be found that an even depth can be maintained more easily by commencing to dig from the lowest end of the drain and this will, of course, permit any water that may accumulate to drain away instead of banking up where the work is being done. A substantial amount of labour can be saved by turning the first spit with a single-furrow plough.

A tile drain trench should not be wider than strictly necessary, and the sides should be trimmed smooth to reduce the risk of small lumps falling in while the tiles are being laid. For a thorough job a draining spade and scoop are essential. The last spit should be dug with the draining spade, giving a bottom that is only just wider than the tile itself When this is cleaned and shaped with the scoop the tile will bed down neatly without risk of displacement

FARM DRAINAGE . . .

Should a portion of the drain be accidentally dug too deeply, every effort should be made to grade out the depression without losing fall rather than to build up the bottom with loose soil, as it is essential that the tiles rest on a solid foundation. If the bed is loose, displacements must occur.

Even the best of tiles may not be precisely square on the ends, and they should, if necessary, be turned to make a close joint at the top to prevent soil from getting in. It is not desirable to force the tiles hard against each other, but even on moderate slopes laying should commence at the lower end to ensure that a tile does not move away from its neighbour.

Filling In

All drainers agree that the topsoil should be thrown on one side of the drain and the subsoil on the other, but there is a difference of opinion as to whether the topsoil or the clay should be returned first. The object of returning the porous topsoil first is to permit the water to enter the tiles more readily. However, water enters the tiles from below, and the placing of loose topsoil on the tiles merely increases the risk of silting. It is therefore recommended that the subsoil be returned to the drain first, and it will be found that the drain not only will function as well, but will probably remain efficient for a longer time. Even when mole drains are being drawn over the tiles it will be found that the disturbed clay will permit water to pass from the moles into the tiles, and when it has settled down channels will still remain.

The laying of tile drains is fairly expensive, but they have a very long life. Meticulous care and thoroughness should be applied, to ensure that efficiency of operation and long life are secured.

Conclusion

In conclusion it may be stressed again that an adequate drainage system is one of the foundations of the whole farm business. Whatever method of draining is chosen, and there are many methods to fit many circumstances, the same principles apply and the same rules should be followed. First, thoroughly plan out the whole system before turning the first sod; secondly, obtain maximum efficiency throughout the life of the system by attention to detail and thoroughness; and finally, prepare an accurate and a permanent plan of the whole system.

◆

Answer to Correspondent

Nicotine and Bluestone Drenches

"H.W.G.," Dannevirke:—

Could you let me know the opinion of your experts with reference to drenching, say, with nicotine and bluestone, particularly the following:—

Does the drench kill (a) the worms, (b) the eggs; if not, do the evacuated worms or eggs contaminate the pastures? If so, for what period? Which chemical does the job? Is arsenic or other poisons a benefit? Is it necessary to drench more than once for lambs going into the works? If the worms are evacuated alive, would it not be a greater benefit to leave them in the animals, to be dealt with in the works, than to spoil the pastures? What are your recommended formulae for the nicotine bluestone drench and dose?

LIVESTOCK DIVISION:—

Drenches such as bluestone-nicotine kill the worms and most of the immature eggs at that time within the reproductive organs of the worm. Those eggs which are almost on the point of being excreted would probably resist the effect of the drench and might, to a small degree, infect pasture, but this infection would not be any heavier than that deposited by an undrenched animal in a single day, when the number of eggs deposited in the droppings might be 800,000 in a heavily-infested animal.

While strongly-resistant larvae may remain alive and infective on the pastures for months—up to 12 months—the large majority die within three weeks, and if a pasture can be spelled for that length of time, infectivity is much reduced.

Incidentally, when phenothiazine is given as a drench, or more particularly in repeated small amounts as in lick form, its presence in the faeces will prevent the development of the eggs.

Copper kills wireworms and the large stomach worm. Nicotine kills a good percentage of the small intestinal worms, also tapeworms.

Arsenic as sodium arsenite has been widely used in South Africa along with copper sulphate as a remedy for the large stomach worm. As it is highly poisonous and requires careful handling, and does not appear to be more effective than copper sulphate alone against this worm, its use is not recommended.

Whether lambs intended for the works should be dosed more than once would depend on several factors: how soon you are able to get them away, degree of infection of pastures, nature of season, convenience of handling, etc.

Where you can quit your lambs off the mother in December or January, one or at most two drenches should be enough. If you hold them till on in February, and have good facilities to handle and drench, and particularly in a wet season, it is advisable to follow a programme of drenching every three weeks from Christmas on. You could check results for yourself by marking and leaving undrenched a percentage of average lambs.

The following is a recommended dosage table for bluestone-nicotine drench:—

2 per cent: Dissolve 16oz. bluestone in 5 gallons of water, and add 16 fluid ounces of 40 per cent. commercial nicotine sulphate.

4 per cent.: Same quantities of bluestone and nicotine, 2½ gallons of water.

5 per cent.: Same quantities of bluestone and nicotine, 2 gallons of water.

DOSAGE.

	2 per cent.	4 per cent.	5 per cent.
Adults	2oz.	1oz. (30 c.c.)	20 c.c.
Two-tooths ..	1½oz.	¾oz. (25 c.c.)	15 c.c.
Lambs, 8-12 months	1oz.	½oz. (15 c.c.)	10 c.c.
Lambs, 4-8 months	¾oz.	⅜oz. (10 c.c.)	8 c.c.
Lambs under 4 mths.	½oz.	¼oz. (8 c.c.)	5 c.c.

A WARNING:—Where lambs are weak, draft them off and give them the next dose lowest down, according to age, and repeat it in ten days; otherwise, with a full dose, they may die.

◆

Applicants for Entry to Flock House Farm

FROM time to time vacancies for trainees occur at the Department of Agriculture's Flock House farm of instruction at Bulls, and intending applicants are advised to apply promptly to the Director of the Fields Division, Department of Agriculture, Box 3004, Wellington, for full particulars. Training, which is free, is open to boys of from 14½ to 18 years of age.

The general aim is to give an initial training in all branches of farming, make a boy self-reliant, instil a sense of responsibility, and give him a favourable outlook on farm life. The term is for 12 months, and applicants may enter at any time of the year.

The following weekly remuneration is paid to boys at Flock House:—

		Held in Savings Account
First 3 months	2s. 6d.	1s. 6d.
Second 3 months	5s.	3s. 6d.
Third 3 months	10s.	8s.
Fourth 3 months	17s. 6d.	14s. 6d.

◆

FARMING IN THE TENNESSEE VALLEY

"The final crop of any land is the People—and the Spirit of the People."

—From a Tennessee Valley Authority publication.

PROBABLY no other single statement could better express the ultimate philosophy of the Tennessee Valley Authority, well known as TVA, than the sentence quoted above from one of the authority's numerous farm advisory publications, as it is to the total betterment of the whole community and in the more abundant living of all the people that the directors of TVA look for the true measure of the success of their efforts.

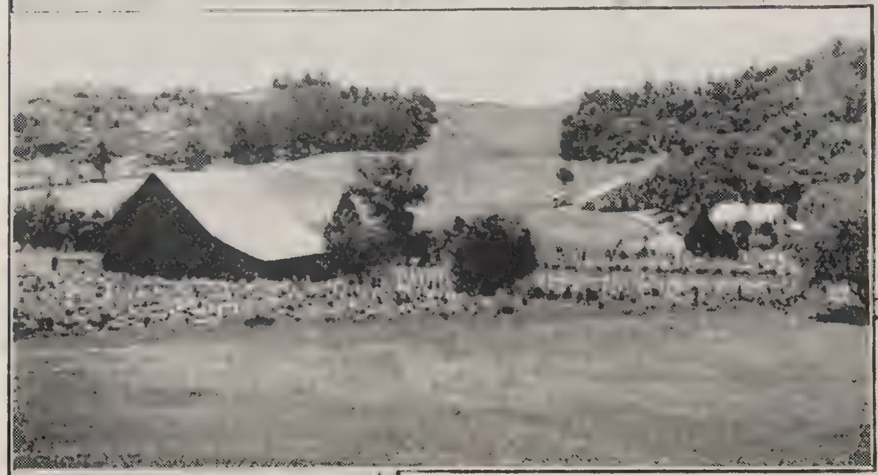
Too often the spectacular evidence of the Tennessee Valley Authority's activities commands so much publicity that it is overlooked that TVA is much more than a series of massive dams and great hydro-electric power generators—much more than a huge flood-control scheme that harnessed an unruly river and converted it into a power-producing and navigable waterway.

All these achievements were but the means to an end—an end measurable only in terms of healthy, prosperous, and happy urban and rural communities. The unique quality of TVA does not lie in its engineering achievements, great as these may be, but in the manner in which this organisation has integrated and co-ordinated all of those factors which add up to a better "final crop."

The tremendous effects on rural and urban life of the farm improvement activities, involving research and advisory work, of the Tennessee Valley Authority are described in this article by N. Lamont, Assistant Irrigation Officer, Christchurch, who returned recently from the United States, where he made a study of irrigation and farming methods in areas where irrigation schemes operate.

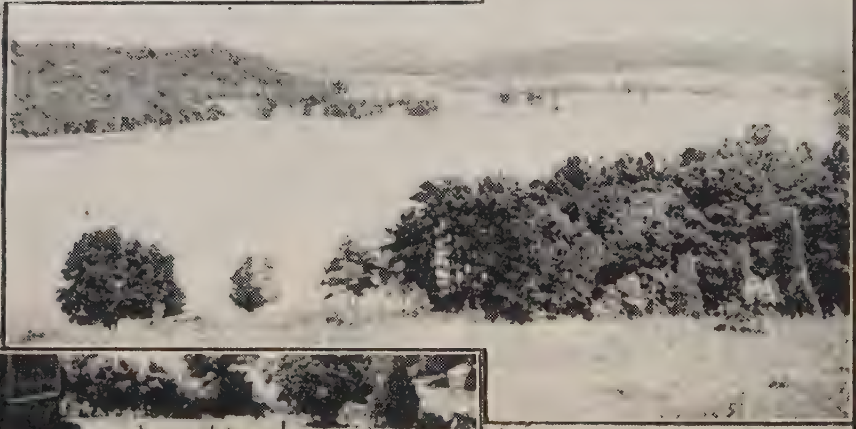
The TVA directors thoroughly appreciated the fact that it was not enough to harness the Tennessee River—that their work would be far from completed when their last dams and locks and power stations were built, if at this time there remained a people who were impoverished, even backward, poorly nourished and spiritless, without security and without hope of ever doing more than scratch a precarious living from rapidly eroding, mineral-deficient soils. And so it was necessary to include in TVA activities a farm improvement programme involving research and advisory work, both directly and through existing

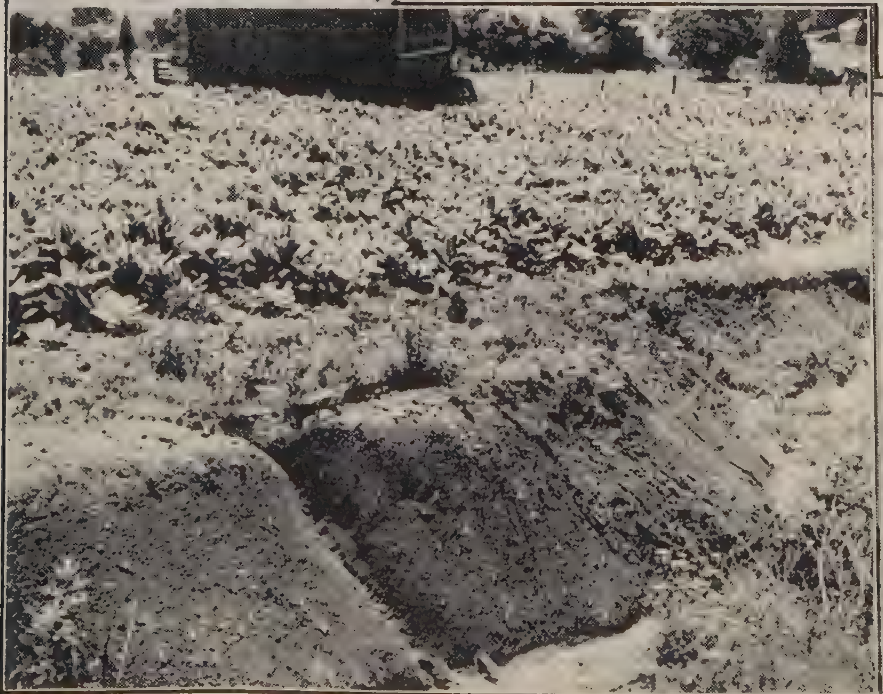
SCENES IN TENNESSEE VALLEY



LEFT—"TEST-DEMONSTRATION" FARM. IN LEFT BACKGROUND IS AN ABANDONED FARM REVERTING TO LIGHT WOODLAND.

RIGHT—FARMING COUNTRY AROUND FORT LOUDON DAM.





LEFT—FIELD OF TOBACCO. SOIL EROSION IN THE FOREGROUND.

services, designed to arrest and reverse the trends of soil fertility loss and erosion that were already in evidence in the region to an advanced degree.

In later articles it is hoped to describe some of the methods that were employed, in particular the part played by phosphates in making possible the radical changes in farming practices and management methods which were necessary to restore stability to agriculture, but before doing so some understanding is necessary of the kind of farming carried on in this area of the U.S.A.

The figures quoted in this article are for the State of Tennessee, as, although the TVA boundaries extend into about half a dozen States, Tennessee itself is reasonably typical and is also a convenient unit in respect to statistics available.

Climate of Tennessee

The climate of Tennessee is very warm and humid in summer, with frosts and some light snowfalls in most winters. The rainfall of about 50in. annually is fairly well distributed except during mid- and late summer, when dry periods of a few weeks may occur with sufficient frequency to justify consideration of supplemental irrigation. Irrigation is not, however, widely employed, and generally most crops are grown satisfactorily without its aid. The soils are reddish brown and the topography generally is rolling—two factors which reminded a New Zealand visitor somewhat of the South Auckland Province. The soils appear to be particularly subject to erosion, and this, combined with a high-intensity rainfall, with brief torrential downpours the rule rather than the exception, makes this problem a very severe one in this area.

Again as in the Auckland Province, most Tennessee soils, with certain definite exceptions, appear to be seriously phosphate deficient and incapable of maintaining good pasture without phosphate topdressing, which is not yet by any means the standard practice that it is in this country.

Mostly Arable Farming

In New Zealand a traveller on country roads is not really conscious of the fact that the road is invariably bounded on each side by stock-proof fences, as these are so familiar a feature of the landscape that they are taken for granted. The frequent absence of fences bounding the roads of Tennessee was therefore one of the first things that caught the eye of a New Zealander, as not infrequently cultivation of corn, wheat, tobacco, or lucerne was proceeding right up to the edge of the road without there being any permanent fence line between. This at once draws attention to one of the major differences between our farm economy and that of the Tennessee Valley, and for that matter many other parts of the U.S.A. The explanation is simply that, whereas in New Zealand "farming" almost invariably means "livestock farming," in Tennessee livestock products, other than poultry and "hogs," often do not play a prominent part in farm returns. In other words, the relative absence of grazing animals, in the paddocks or travelling the roads, makes it less necessary to provide a stock-proof barrier along the farm boundary, and quite commonly this is not done. Statistics indicate that about 40 per cent. of the total 18 million acres in the State of Tennessee is in crop, and since over 25 per cent. of the State is described as "woodland" or "woodland pasture," it is evident that the agriculture of this area is essentially an arable one. The remainder of the farm land of the State, rather less than 40 per cent. of the total farm land, is described as "pasture," a term which it was found is used with rather more elasticity than we would accept in New Zealand; much of it would be better described as "rough grazing" or even "light scrub country," and is often composed of a variety of rubbish of which pasture grasses are only a small proportion. Pasture is, in fact, commonly relegated to that part of the farm that is considered too poor for anything else, and while this attitude prevails it is not surprising that pasture management is generally of a low standard.

In a later article the work of TVA agriculturists will be discussed, which aims at encouraging an increased appreciation of the value of topdressed and well-managed pasture both as a profitable source of farm income and as a valuable soil-conservation practice.

The Main Crops

At least until the efforts of TVA and other conservationists began to have effect, the main income of Tennessee farmers was derived from row crops—either cash crops such as cotton and tobacco, or cereals used partly to feed pigs and poultry on the farm and partly sold for cash.

Corn (maize) was easily the most popular crop and probably accounted for nearly half of the total crop area. The bulk of the corn is used for feeding on the farm to pigs and poultry with some made into silage for larger livestock, and some, of course, used for human consumption.

Cotton has been the most important cash crop with tobacco also very prominent—the two together accounting for two-thirds of the crop income.

The remainder of the list of crops includes potatoes (sweet and ordinary), vegetables, wheat, and other cereals with a few minor items such as fruit, strawberries, peanuts, etc.

A fair proportion of the cropping area, probably about one-fifth, in any one year is devoted to hay crops which consist of various legumes—lespedeza, red and crimson clover, alsike, lucerne, etc.—with some timothy and oats.

Amazingly Diversified

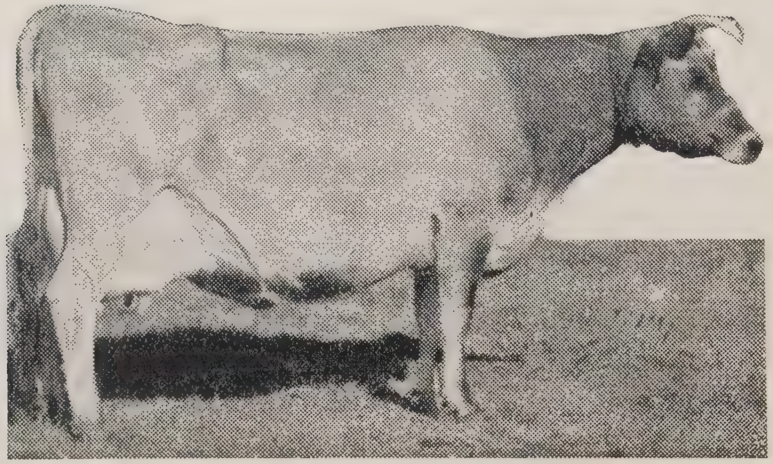
It will be apparent that farming in this region is, by our standards, amazingly diversified, and a typical Tennesseean farmer will derive income from many sources. In a census of 1930 farms were grouped according to the major item of income and placed under a certain classification if 40 per cent. or more of the farm income was derived from the source described by the classification. According to classifications made on this basis about a quarter of farms were "cotton farms," a quarter were "general," and another quarter were "small general" farms. By "general" is meant farms whose source of income was so diversified that no particular item featured largely enough for them to be placed in a named group. The classification "small general" is very significant, as it refers to "farms" whose production, while very diversified in nature, was consumed largely on the premises—up to two-thirds of the total production being consumed by the occupier and his family. Only about 8 per cent. of farms were described as depending on livestock production, apart from poultry, for more than 40 per cent. of the total farm income. In other words, only about 8 per cent. of Tennesseean farms at that time even slightly resembled typical New Zealand animal production farms.

The high degree of diversification of production was distinctly noticeable and each farm appeared to have its few acres of tobacco, a few acres of corn, a few acres of wheat, probably an acre or so of tomatoes, potatoes, etc. The reason given for this was that in the past prices have fluctuated widely from year to year, and further that the majority of farmers had insufficient financial margin in cash or credit to be able to risk the possibility of low price seasons coinciding with their concentrating on one or two crops. Their only hope of carrying on was to spread their risks over a variety of forms of production.

Small Farms Preponderate

As the above details indicate, most farms are small and the State average is probably less than 70 acres, with a

TOPS N.Z. FOR 1946



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fair range about the average, from the relatively large livestock farms of over 200 acres down to vegetable and poultry lots of a few acres.

It is considered that in some sections of the State farms are uneconomically small, with the result that in an effort to extract a living from the soil a very intensive cropping system had been followed, with consequent serious depletion and erosion. It is this trend that the TVA agriculturists, in co-operation with other services, have set out to correct. Fertility-building and soil-protective practices had to be substituted for the disastrously destructive methods commonly practised. In practice this meant the encouragement of rotations that included a higher proportion of fertility-building crops, the extended use of good pasture, and the adoption of cultural practices such as contour tillage.

"Test-Demonstration" Farms

The methods and practices advocated had to be profitable to the individual farmer and finally their value had to be demonstrable to the farmers in a practical way. The educational method adopted by the TVA workers centred largely around "test-demonstration" farms. Under this arrangement a farmer, often nominated by other farmers in his locality, would enter into an agreement with the TVA and other interested institutions, which bound him to follow what was, in effect, a plan of farming based upon conservation principles, while in return all the advice and assistance that TVA could provide was made available to him together with free fertiliser for trial purposes on a farm scale.

Invariably the success of these test-demonstration farms had a widespread influence on farm practice in the immediate vicinity, as farmers could see for themselves the practical results being achieved by their neighbour under TVA direction. As a consequence, these farms have become the centres of test-demonstration communities where not only all aspects of farm management, but rural domestic and social amenities are discussed and considered to the advantage of the community as a whole.

A Tennessee home of the old pillared type.

"Final Crop" Built Up

As a consequence, the health, prosperity, and morale of the people—"the final crop of any land"—have been built up. Individual farmers no longer feel they are helpless to correct the steady deterioration of their lands but feel they have not only stability, but an expanding future. Butter, cream, cheese, and eggs are appearing on farm tables that in the past saw too much of corn mush and salt pork. Washing machines, refrigerators, and a variety of electrical gadgets are being bought and operated cheaply on the cheap and abundant power generated from TVA dams. With confidence in their future, communities are co-operating in building social halls, new school houses, and churches.

Crop of maize.

And so TVA reaps the "final crop of the land." Their land and farm management improvement programme is of particular interest from a technical point of view, as their achievements and intentions, particularly in respect to phosphate use, so closely resemble our own experience in New Zealand—a point of which they are, incidentally, aware and which makes New Zealand of particular interest to them. On the other hand, although one's attention tends to focus on the technical agricultural aspect, this is only a part of the story, and to appreciate that part in full one must also be able to see its relation to the whole and appreciate the basic TVA philosophy which makes soil conservation not only a technical problem, but also a real contribution to community welfare.

* * *

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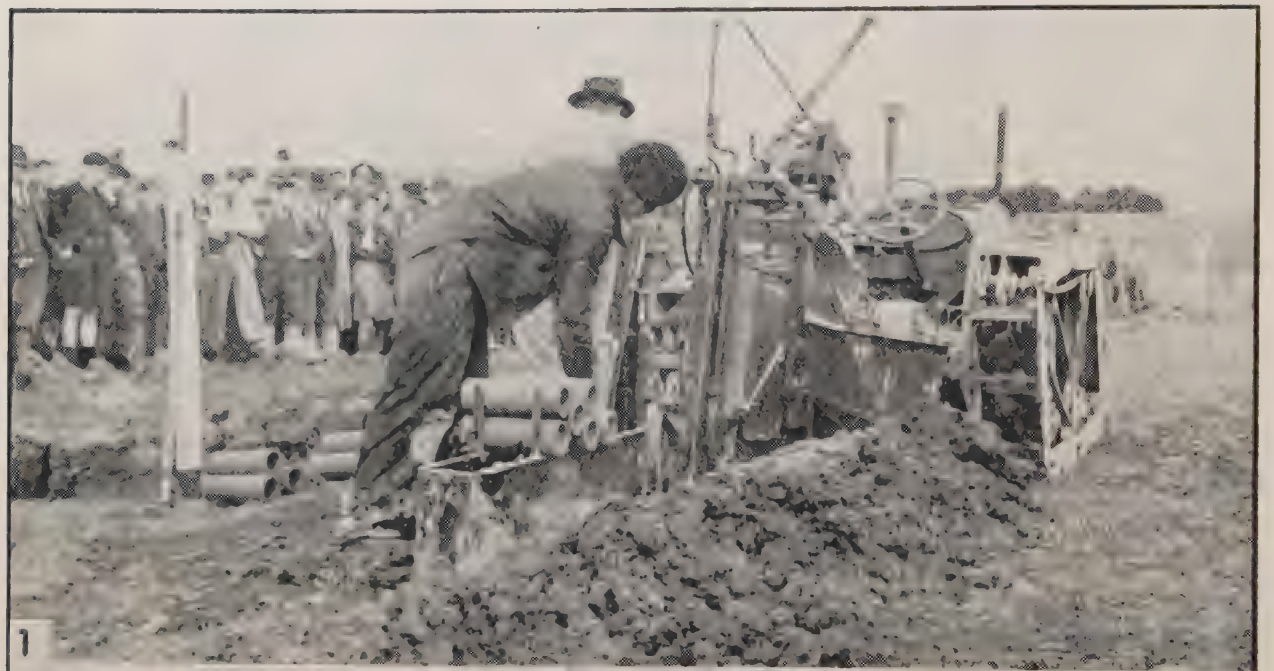
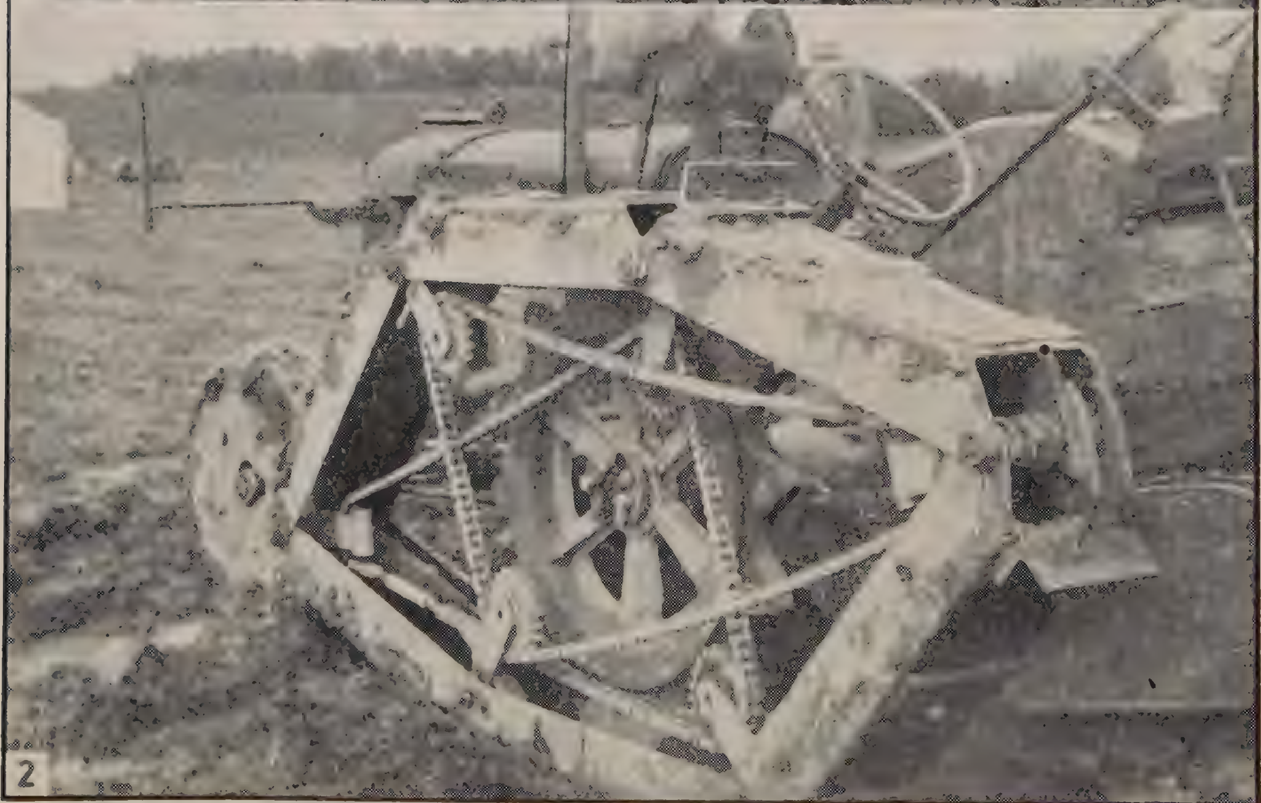
DEMONSTRATIONS OF





1. The "Rotohoe" at work. The man at the left is guiding the machine and regulating the depth of cut by remote control sighting along the boning rods set out on the course of the drain; the man at the rear is laying the tiles through a chute at the back. The trench is dug to the full depth by means of roto tiller blades and the spoil is discharged to one side clear of the trench. 2. Special track-laying gear of the "Rotohoe" designed to translate the power of the tractor to the required slow but positive forward movement of the machine as the drain is dug to the full depth.

DRAINAGE MACHINERY

By **A. J. GALPIN,** ***Fields Instructor, Palmerston North.***

A TWO-DAY demonstration of some modern farm drainage machinery recently arranged by Massey Agricultural College attracted wide interest, farmers and farm contractors being present from the South Island as well as from most districts of the North Island where land drainage is a problem. The numbers of Manawatu and Rangitikei farmers present on both days indicated their keen interest. Although chief interest was shown in the "Rotohoe," a combined tile drain-digging and tile-laying machine recently imported by Massey College from England and the first of its kind to come into this country, some other locally-made machinery demonstrated the initiative and ingenuity of practical New Zealand farmers in the production of machines capable of reducing very considerably the labour and cost of farm drainage. Among these the drain-digging machine demonstrated by Mr. Guy Lewis, of Eketahuna, was outstanding.

Some of the machines seen at the demonstration were:—

The "Rotohoe," a drain-digging and tile-laying machine capable of laying tiles 24in. deep at the rate of 10 chains an hour. Depths up to 36in. are within the range of the machine, which is shown in illustrations 1 to 4.

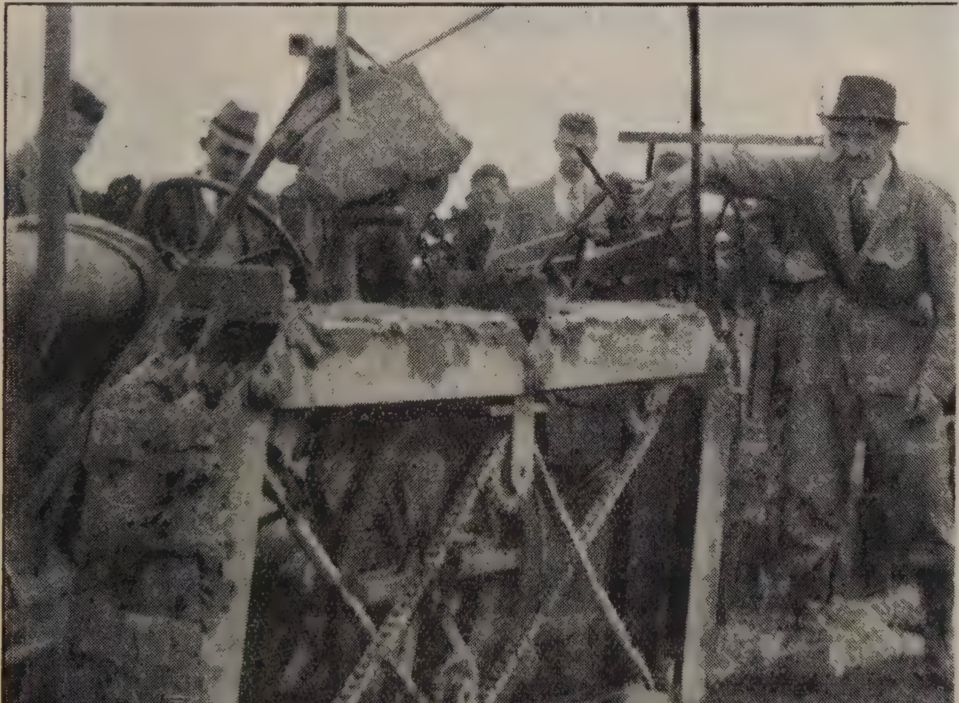
A special angle dozer for backfilling tile drains, which further reduces the labour required.

The Guy Lewis drain digger, a locally-made trench-digging machine designed by Mr. Guy Lewis, an Eketahuna sheep farmer, for digging tile drains on recently-stumped and rush-covered river flats. The machine digs a trench 11in. wide and up to 26in. deep at the rate of 15 to 20 chains an hour on rough swamp land and is capable of much faster work on clean pasture land. It is designed to ride over roots or timber buried in the ground, leaving it ready for the axe, and operates effectively on rough swamp surfaces as well as on clean land.

Linton Bros.' tile drain digger. The third tile drain-digging machine was demonstrated by Mr. M. Lankshear, Manawatu. This machine, which was designed by Messrs. Linton Bros., of Carterton, is of quite simple construction, and on clean country is capable of digging ditches for tiles 4 to 6in. wide and to a depth of 36in.

Tractor power-lift-operated mole drain plough. The Manawatu Machinery Agency demonstrated an English tractor operating a standard type mole drain plough by means of the power lift gear.

Among other aids to good farm drainage which were demonstrated were simple methods of cutting tiles and cutting holes in tiles for junctions, various types of equipment for taking accurate levels, and equipment for placing a tile in the end of mole drains which has been illustrated in a previous issue of this "Journal."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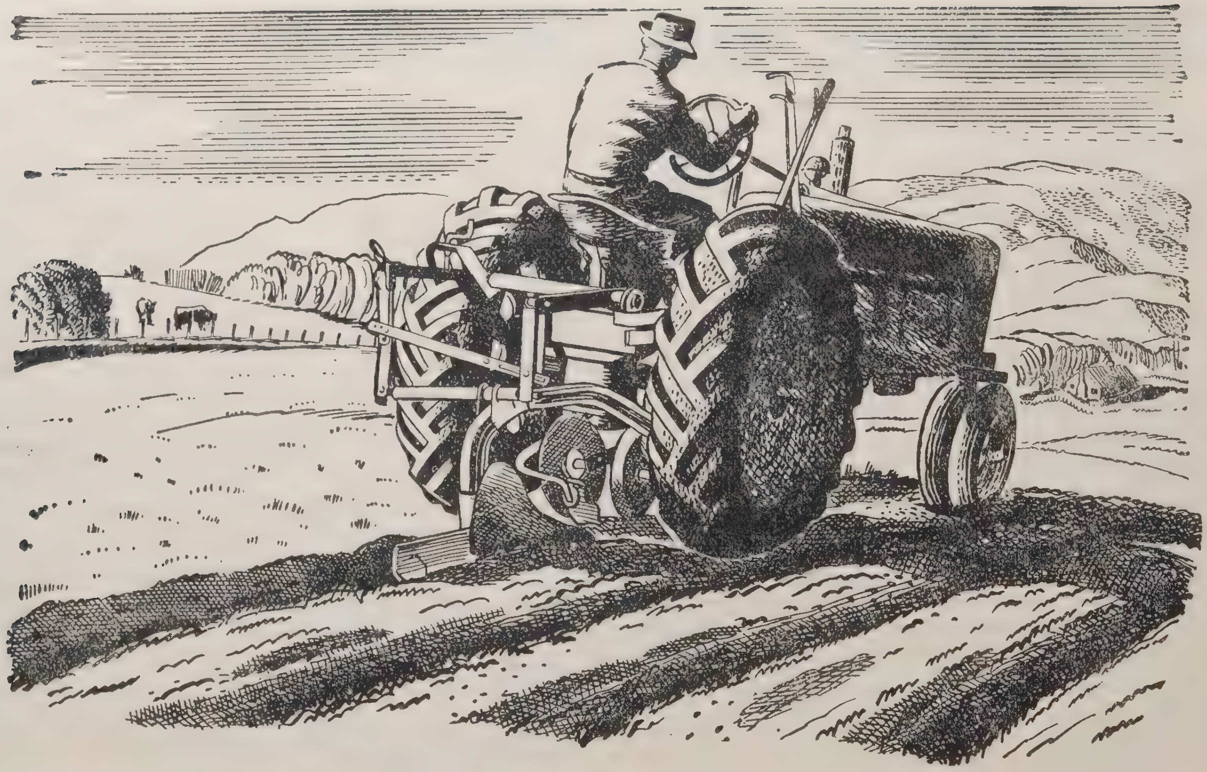
3. Operating the remote control gear. As the machine moves slowly forward the direction and depth controls are easily operated. 4. The completed trench with tiles as laid by the "Rotohoe." *(Note:* At the time of the demonstration the land was too wet for really good work and the operators were not yet experienced in the manipulation of the machine.)



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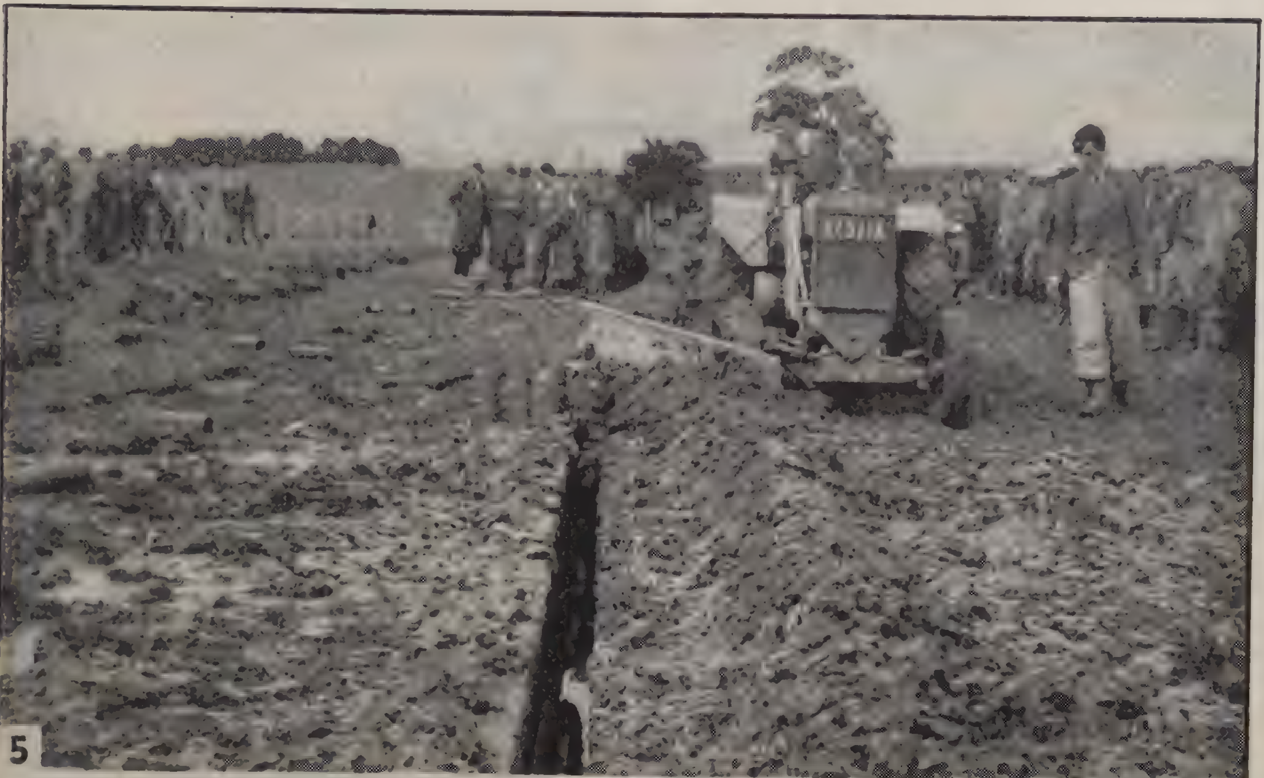

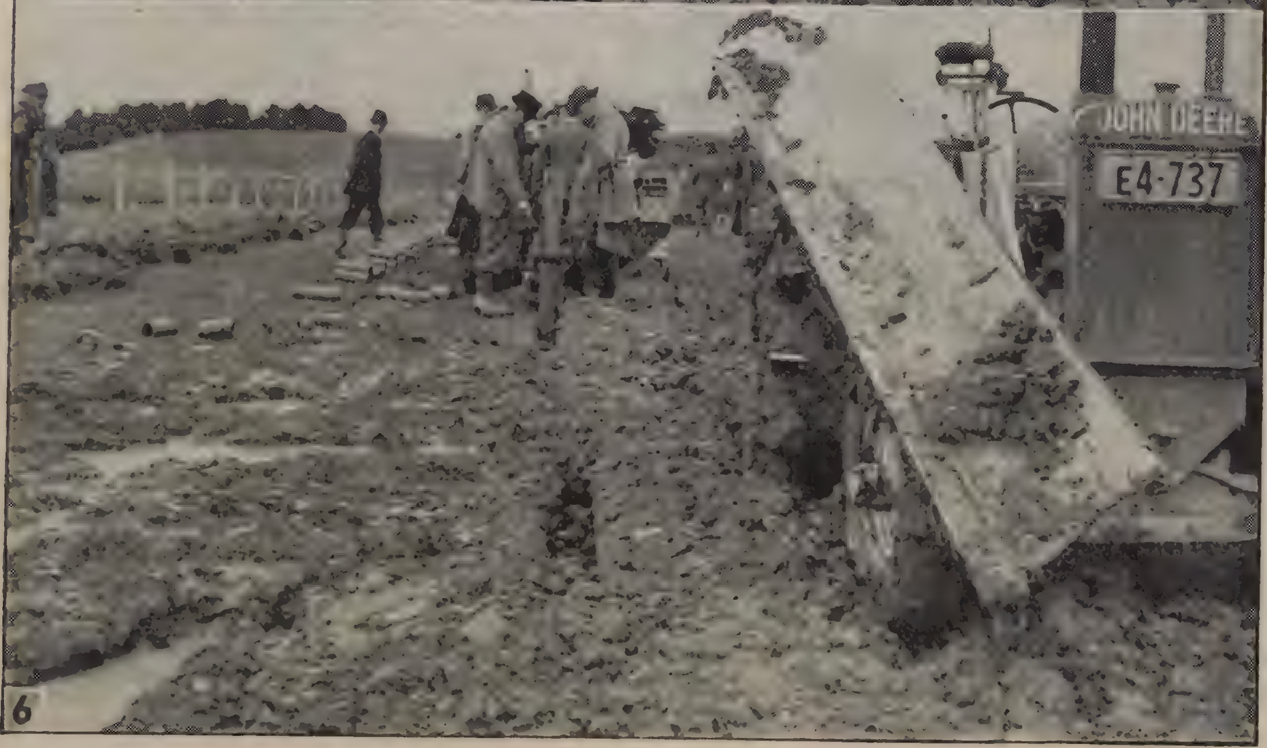

5. The angle dozer backfilling. With all spoil to one side as left by the "Rotohoe," one run of the machine will do the job. 6. The angle dozer blade lifted to the carrying position.

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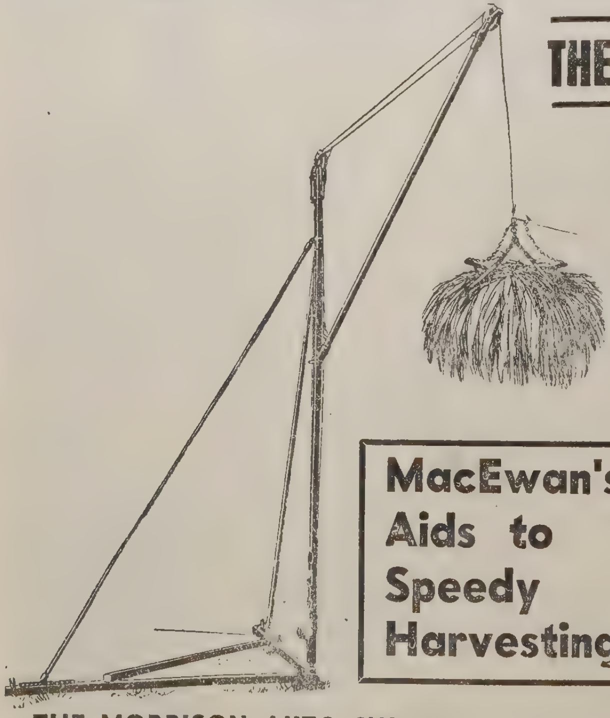

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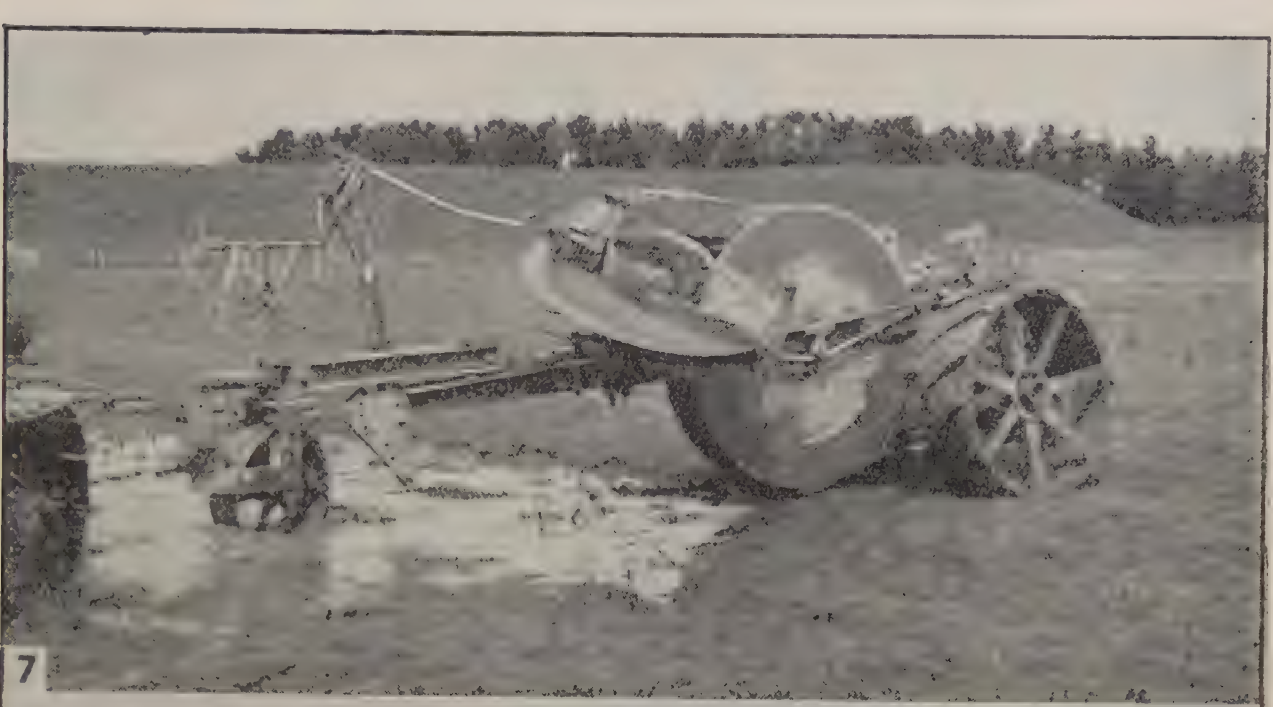

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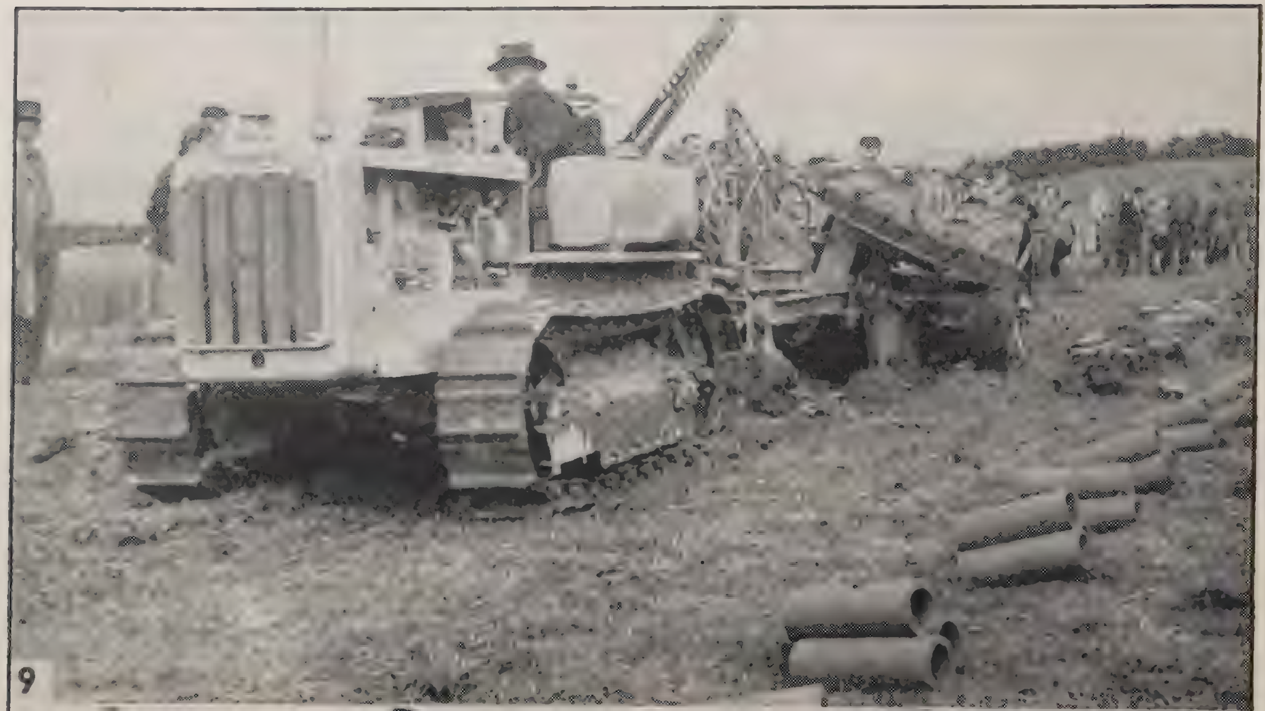
7. The Lewis drain digger. The vertical pair of discs cut into the ground, the cut section being picked up between the discs and carried over the top for discharge on to the rotary horizontal disc which carries the spoil well clear of the machine and tractor. 8. The Lewis digger in action. A cut 6in. to 8in. deep is made with each run; the front wheel enters the ditch and regulates the depth of the second and subsequent cuts.



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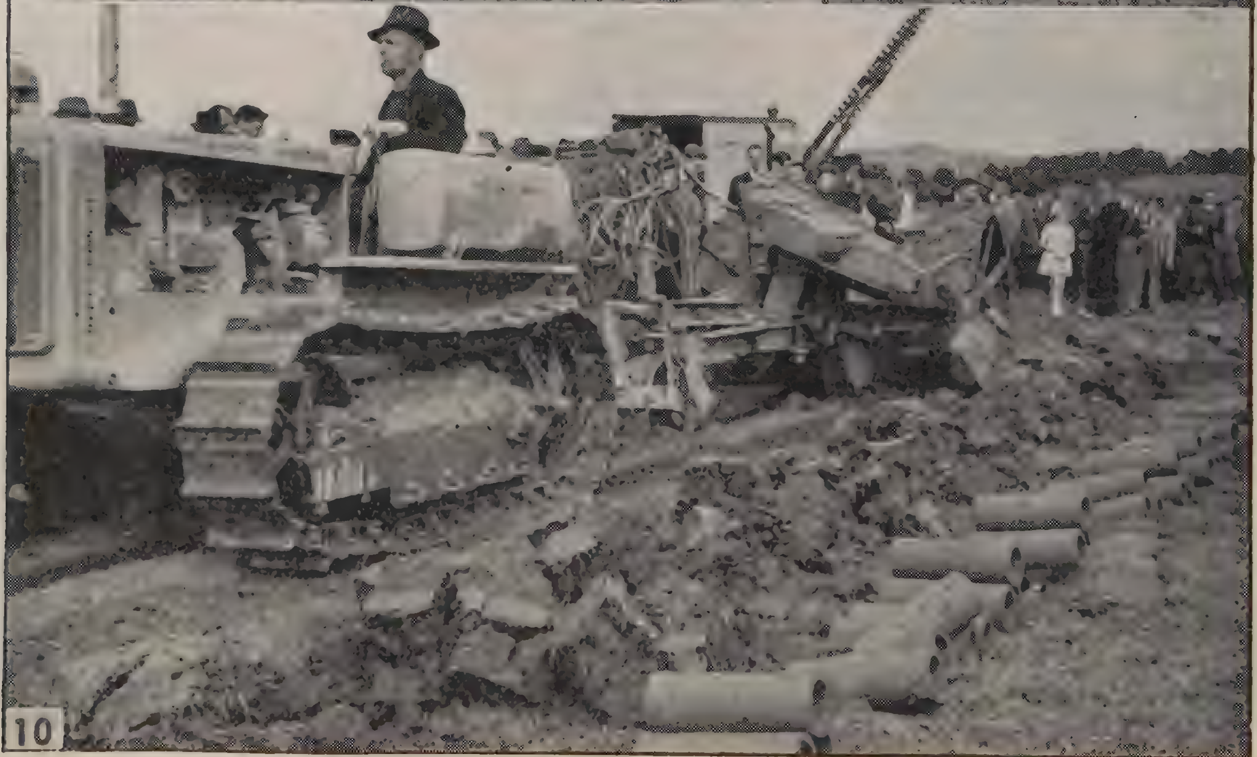

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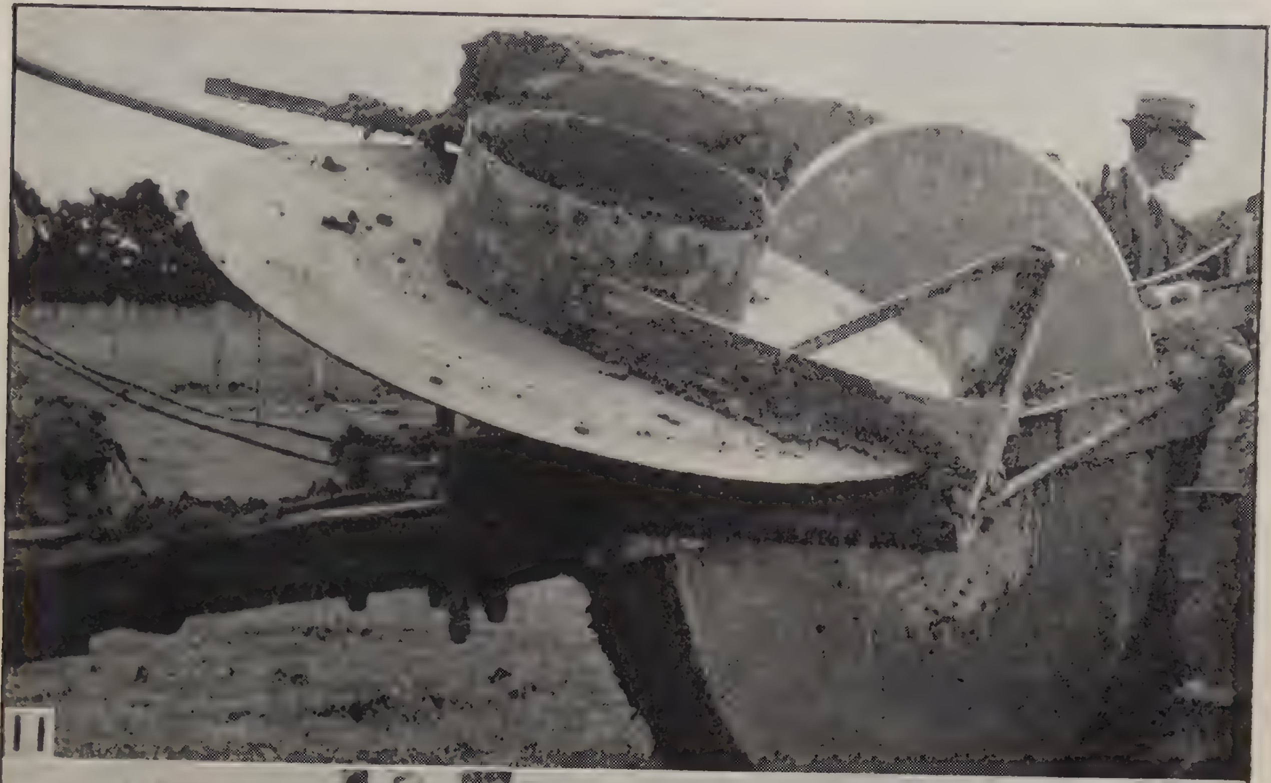
9. The Lewis digger making the second run. Another drain is cut on the return run to the beginning of the first; this puts the spoil all on one side of each drain. 10. The Lewis digger in the second cut; 3 or 4 cuts are required for each drain 24in. to 26in. deep. *(Note:* By fitting larger discs greater depths can be obtained; likewise the width of cut can be reduced or enlarged by altering the space between the discs.)



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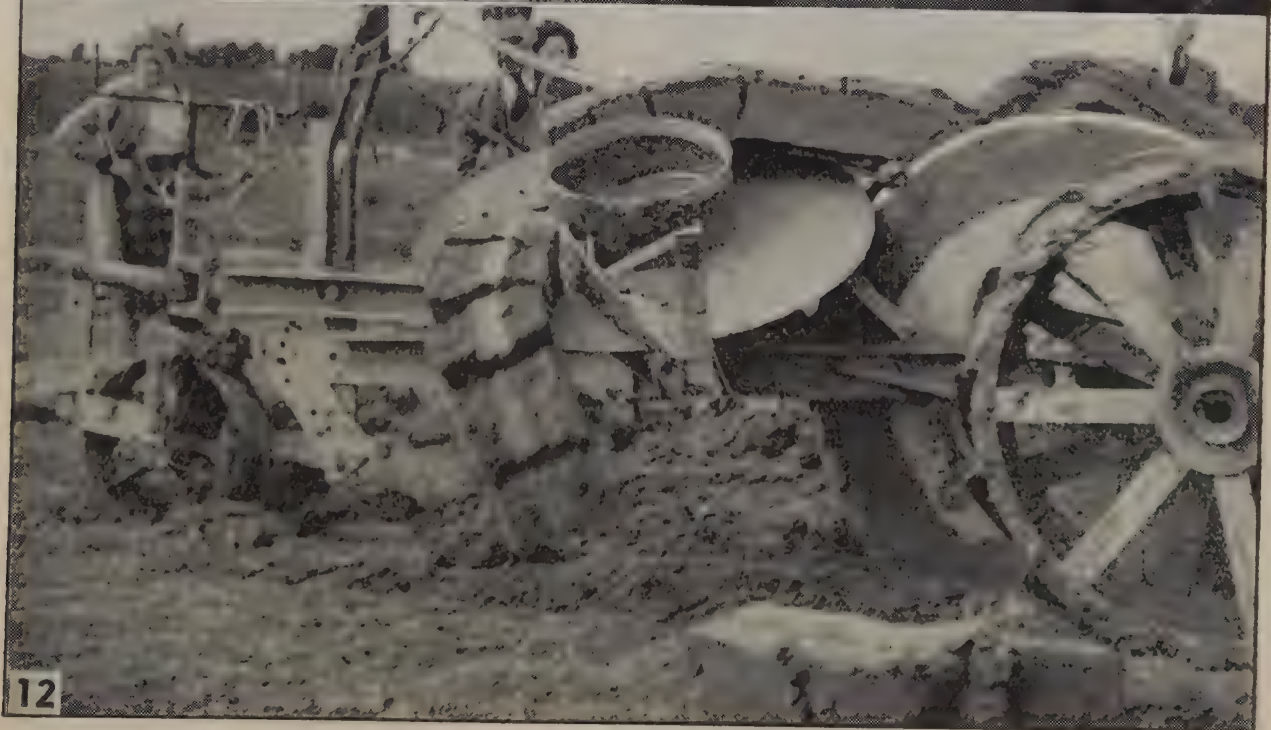

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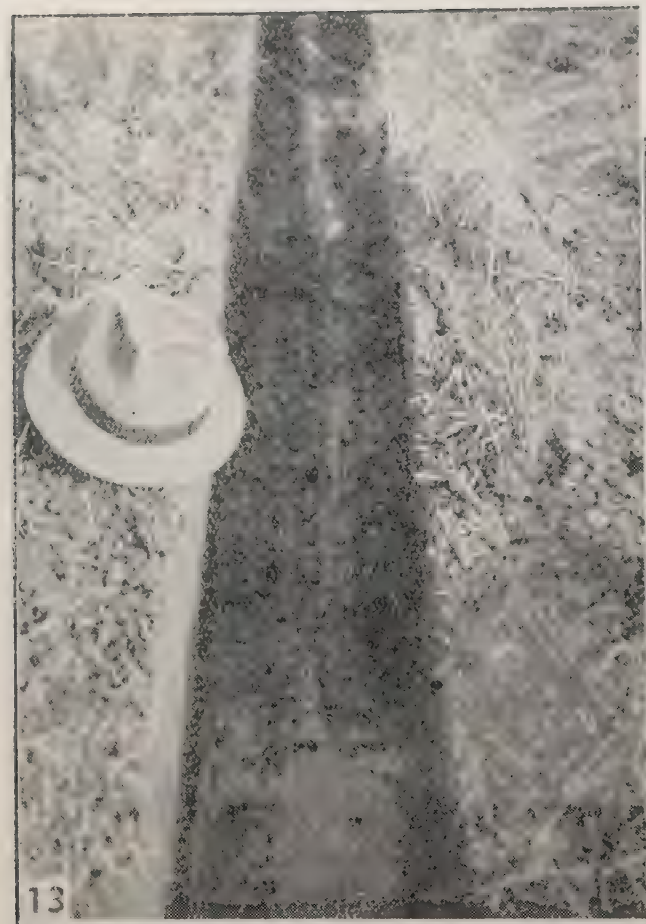
11. The revolving disc which carries the spoil 5 or 6ft. clear of the side of the drain, leaving plenty of room for the machine to operate in successive runs along the drain. 12. The discharge of spoil from the Lewis drain digger. *Note:* Both the cutting discs and the conveyor disc work by friction only. There are no gear-driven parts on the machine.

FARM DRAINAGE MACHINERY DEMONSTRATION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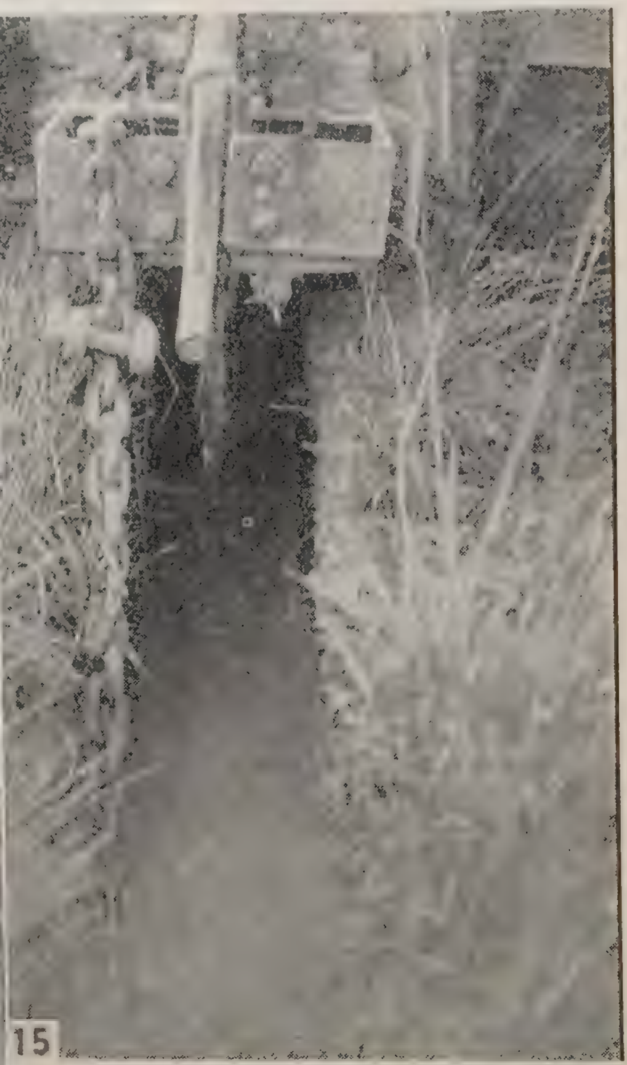
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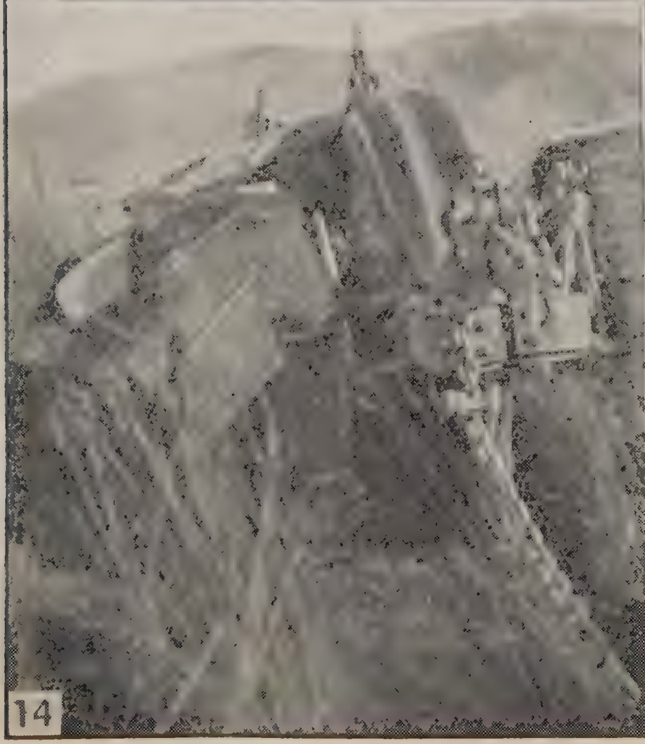
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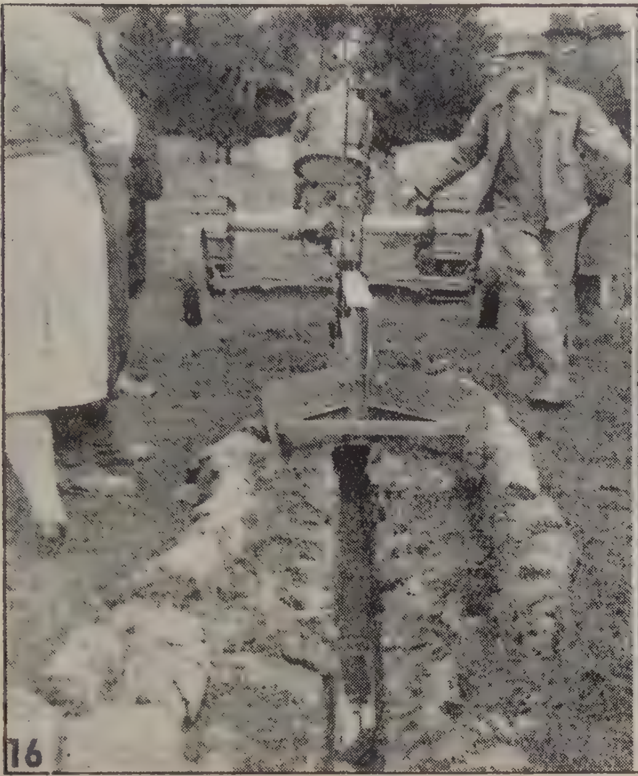
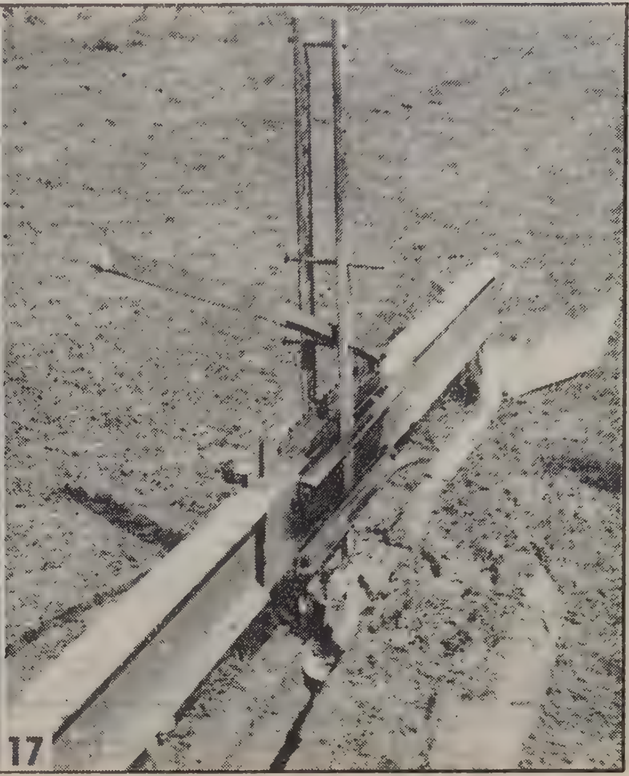
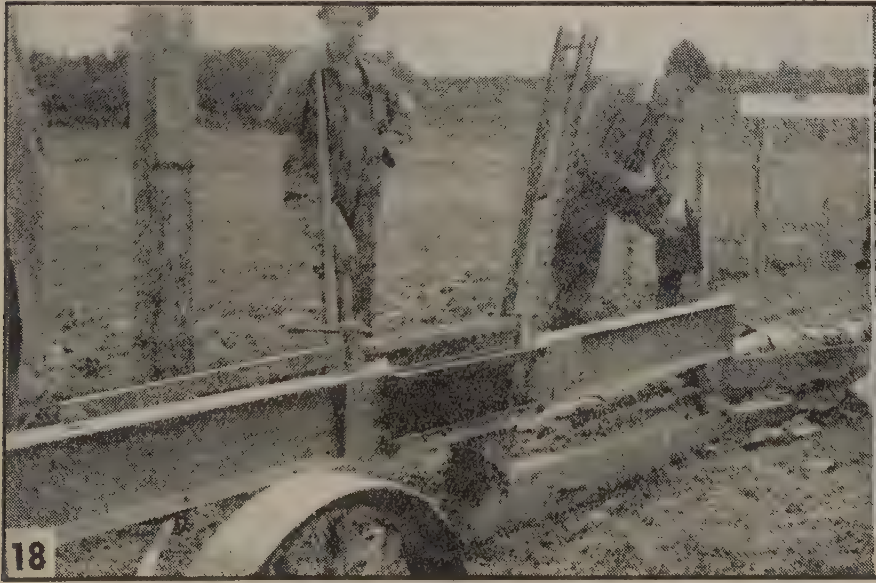
13. The completed drain as dug by the Lewis machine. Note the clean-cut sides and freedom from loose spoil in the bottom. The drain is ready for grading for the tiles. 14 and 15. The Lewis ditcher operating in swamp country for which it was originally designed. Either rear wheel as seen in Fig. 14 can ride over bumps and hollows without altering the operation of the machine on an even keel. (Note the earth packed between the discs.)

Fig. 15 shows the freshly-cut ditch full of water in really wet country.





16. The Linton drain digger making the first cut, of 5 to 6in., by a special blade which is regulated for depth at each cut. 17. The Linton machine entering the end of the drain for the second cut, which is made by a sharp scoop and slot through which the soil is forced into an inclined slide which fits the trench. Seven to eight cuts are required for the full depth of 36in.



18. The Linton machine in action. The spoil is lifted up on the slide bar and is pushed to either side by the wings fitted to the rear of the frame. 19. A completed drain ready for grading and bottoming as dug by the Linton ditcher on a Manawatu farm. The shaped cutter and scoop reduce to a minimum the work required to finish the drain.

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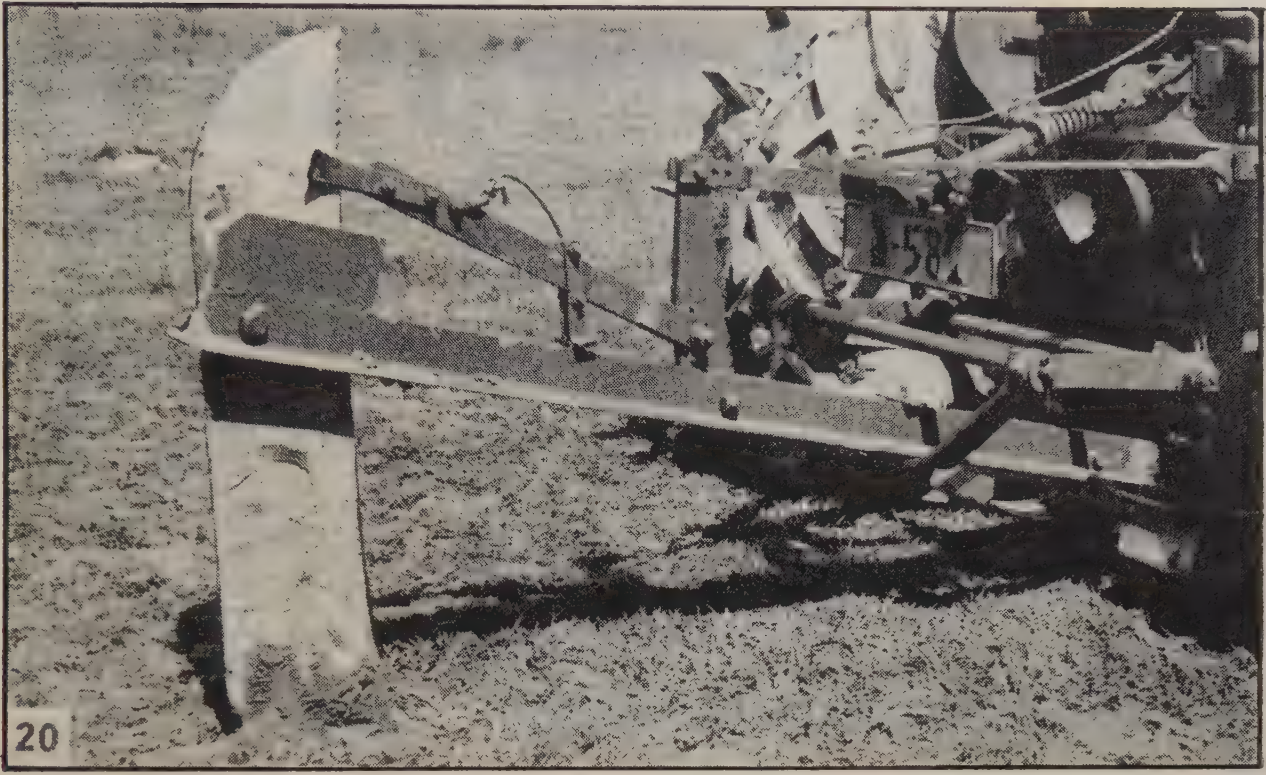
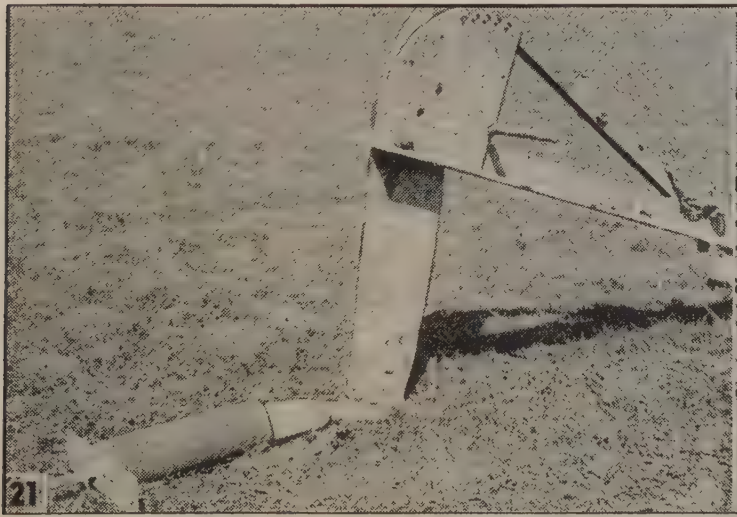


20. The mole drain plough lowered into position ready to pull away. At the end of the run the depth regulator bar is tripped by means of the rope; the plough is lifted out of the ground by the power lift and when in position for the next run the depth regulator is set in position again from the tractor and the plough lowered into position. The plough can readily be manipulated into any desired position to start a mole drain.



21. The Sykes tile puller. The puller with a tile in position is fitted to the end of the plug of a mole plough as the plug is about to enter the side of an open drain. As the plough moves forward the tile is pulled into the end of the mole drain and the plate at the rear pulls out the rod from a special joint, leaving the tile firmly in position. 22. Two tiles in the side of an open drain as pulled by the apparatus illustrated in Fig. 21.

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ARTESIAN WATER RAISED 80FT. WITH A RAM

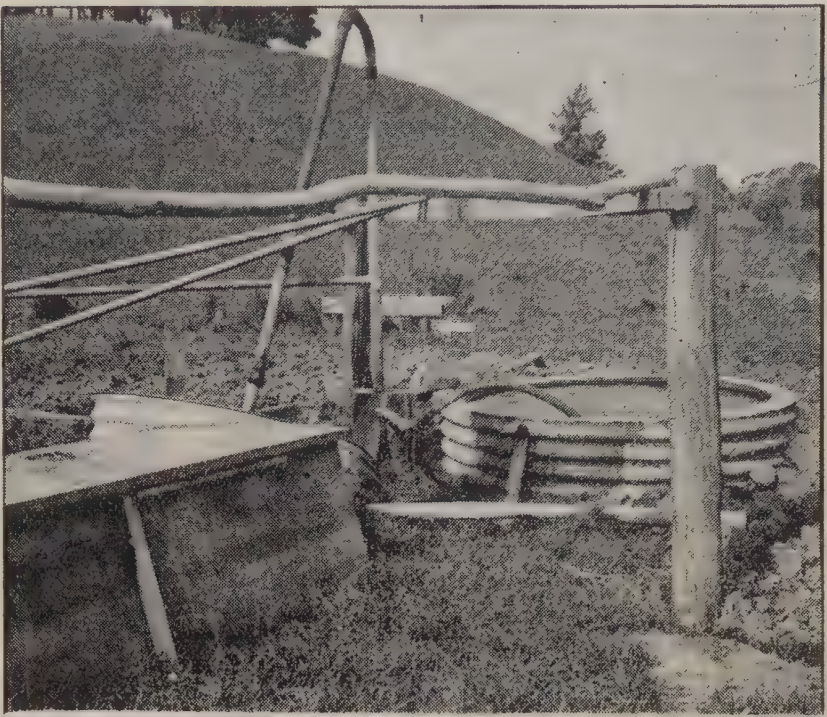
By **P. S. SYME,** *Instructor in Agriculture, Warkworth.*

MOST men when boring for water would be only too pleased to find a good supply at a reasonable depth. If, like Mr. W. A. Smith on his farm at Kaipara Flats, they had the good fortune to strike at 90ft. an artesian gusher rising to 8ft. above the surface, they would probably be thankful for so convenient a supply of water which needed no pumping and be content to leave it at that.

NATURALLY, Mr. Smith was very pleased to have found a water supply which could gravitate to every field on the farm. The bore was conveniently situated and a limitless supply of crystal-clear water gushed out like a fountain. What more could any farmer want?

Mr. Smith wanted more. He wanted the water to rise by its own power to his cowshed about 300yds. away and 80ft. above the level of the bore. What was more, he knew how that could be accomplished at very little cost. Though the problem might have appeared difficult, Mr. Smith solved it efficiently and simply by installing a ram. The 8ft. head of pressure combined with the copious flow provides plenty of power to operate the ram, and though a considerable proportion of the water runs to waste, that is of little consequence in view of the inexhaustible supply.

Farmers who, like Mr. Smith, were confronted with a failing water supply during the drought of the last summer will appreciate his relief in now having water in abundance, and the pleasure it gave him to be able to advertise his old pressure pump for sale.



ILLUSTRATIONS

Upper: A view of the bore. There is a concrete seal above the casing to prevent contamination. The flow is sufficient to operate the ram in the middle background and still maintain an overflow from the trough. The water is forced up the hill in the background.

Lower: The ram in operation. The proportion of water running to waste may seem extravagant, but it costs nothing and the supply is limitless. The ram, fed from a 1½in. pipe running underground from the bore, forces the water through a ¾in. pipe to a tank at the cowshed about 300 yards away and 80ft. above the surface of the bore.

THE GOOD NEIGHBOUR

Waikato's Whare Whakairo

CARVED HOUSES

TO the majority of New Zealanders the name Ngaruawahia is for ever linked with that of Princess Te Puea Herangi, who has devoted her life to establishing a people dispossessed of their lands during the Maori Wars in homes of their own on a site sacred in the annals of the tribe. Of direct descent from Potatau Te Wherowhero, the first Maori King, and tracing her lineage back through 28 generations, this nobly-born chieftainess has toiled hard and long for the realisation of her dream, even contracting for scrub-cutting and similar work so that the revenue obtained could be used to buy sufficient land on which to build a village. It was in this manner that Ngaruawahia Pa came into being.

King Koroki's house.

ONE of the earliest examples of her practical interest in the welfare of her race was her adoption of the children orphaned in the 1918 epidemic, and these young folk for whose upbringing she had been responsible loyally assisted her in all her undertakings. Indeed, in later years, when Te Puea conceived the idea of erecting a house for tribal gatherings in that part of Ngaruawahia called Turangawaewae, they toured the country with their leader giving concerts in the various centres to help raise funds. (The Princess is also head of several land development schemes under which numbers of Maori settlers have been very successfully established in farming. The recently-opened Health Clinic in the Ngaruawahia township, which has an average attendance of over 100 patients weekly, is also under her auspices.)

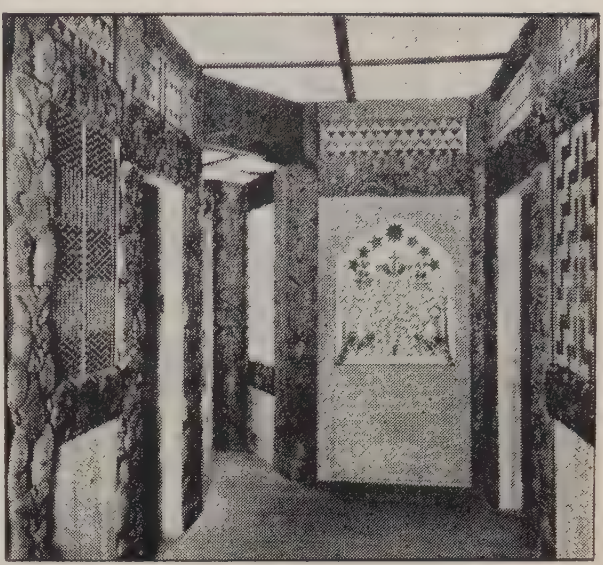
As the visitor approaches Turangawaewae, where poppies and geraniums flame against the outer palisade of pongas and brilliant flower borders and curving lawns form a jewelled setting for the marvels of Maori arcihtecture within, he is confronted with tangible proof of the outstanding capabilities of this gifted woman under whose leadership such a wonderful transformation has been wrought in the gorse-covered wilderness surrounding the spring which had once belonged to her grandfather, King Tawhiao. On one side of the marae is the Kimikimi, the big social hall, used mainly for meetings and the arts of whare tapere (house of entertainment), and having a kitchen extensive enough to cater for a whole community when large gatherings are held. At the other end of the courtyard stands the carved house called after Princess Te Puea's famous ancestress of 18 generations back, Mahinarangi, "the Moon-glow of the Heavens," whose love story was as perfect as her beauty. It is indeed fitting to commemorate the Waikato chief who won her heart, and to bestow upon the residence of King Koroki, which adjoins Mahinarangi, the name of Turongo.

Seated on the marae with the other guests while the elders of the tribe, bearing green-leaved branches of rata in their hands, accorded us a powhiri (a ceremony of welcome), I had an excellent opportunity to observe the peerless loveliness of the carved timbers adorning Turongo and Mahinarangi House, the red carvings making a rich note of colour against the sombre background of tree-shaded river and storm-dark peaks of the distant Hakarimate Ranges. The tall flagstaff in the centre of the courtyard is a striking example of the carver's skill; so, too, is the porchway pillar in front of Mahinarangi, with its ancestral images and taniwha emblem known as Waikato-taniwharau, "Waikato-of-the-hundred-dragons," indicating the superior strength of the tribe who boasted a village with a fighting chief at every bend of the river. A taniwha also disported itself beneath the window which was surmounted by a carving of the Tainui canoe, commanded by Hoturoa. Two round white stools, each a portion of a whale's backbone, stood on the porch near the great doors of Mahinarangi upon which was carved Te Paki-o-Matariki, the King's coat of arms. This depicts two figures, Whakaora, the life-giver, and Hani, the destroyer, striving for mastery over Te Ao, the universe, represented by a circular scroll. Between their upraised hands is set the Cross, signifying that in the struggle between good and evil in the world Christ is victorious, supreme. The seven stars overhead symbolise the fleet of canoes which took part in the early migration to Aotearoa (New Zealand), and the large star in the centre typifies the celebrated canoe of the Tainui tribes. To show man's dependence on the products of Nature the design is further embellished by nikau fronds, used for the thatching of dwellings; harakiki (flax), of which clothing and cordage are woven; mamaku (black tree-fern), providing posts for palisades, para (king-fern), the edible roots of which are regarded as a delicacy and reserved for the sons of rangatiras.

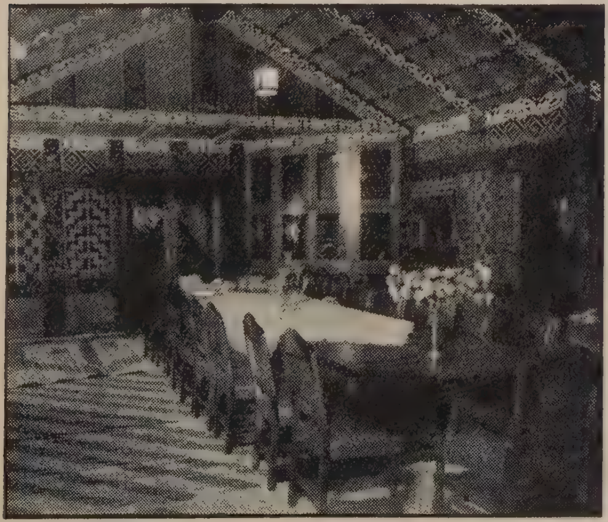
Upon entering Mahinarangi I found the interior exquisitely beautiful with its intricate wall carvings, its rafters decorated by a myriad designs of scroll work, and its tukutuku panels of reeds woven in "step pattern," "star-seed pattern," "tear-drop pattern," to name but a few. The entire floor was carpeted and there were additional whariki, mats woven from flax and kiekie, those trimmed with bright-coloured wools having been made in Rarotonga. What at first glance I had thought to be a bone, judging by its shape and smooth, bleached surface, was in reality a kava root, the gift of Queen Salote of Tonga. The gay grass skirts which formed such decorative window drapes were also from the islands (I particularly liked one with a blue velvet waistband cut in points and embroidered with pearly shells), as were many of the necklaces and leis and triangular-shaped fans displayed round the pillars. Nearby stood a graceful antique cabinet which had been presented to Princess Te Puea; its glass-fronted shelves contained many mementoes—cups and saucers inscribed with the names of leading British makers of fine china; a tiny throne of silver filigree on a tortoiseshell base; a facsimile of the Coronation spoons used for anointing the King (a presentation from the Countess of Oxford); and a set of silver fish knives and forks with handles of greenstone. On top of the cabinet were valuable Dresden vases filled with flowers.

The dais at the rear of the hall was a museum of treasures — meres and moa bones and mounds of unpolished greenstone; water gourds and a whole set of shark's teeth (much sought after for ear-rings); kiwi cloaks and canoe mats worn when paddling; paddles and patu patus (carved clubs) tewhatewhas and taiahas (spears used in battle). I felt most privileged to be allowed to handle a highly-prized cloak covered with crimson kaka feathers: how beautiful it must have looked on some dusky-haired Maori maiden. Other interesting items comprised the insignia of a Commander of the Order of the British Empire with which Princess Te Puea was invested in 1938; a dark, glossy kauri root that by some strange whim of Nature resembled a group of gnome-like figures such as those in an Arthur Rackham illustration; a clay effigy of a noted ancestor round whose neck hung a handsome tiki and a flat pendant ornament of paler greenstone; an Indian sari of royal purple with stitcheries of gilt thread, the silken folds serving as a curtain for a recess at the left of the platform; and a musical box given to King Tawhiao by Queen Victoria during his visit to England. The box had a repertoire of some half a dozen tunes, Strauss waltzes predominating, and later, when the mechanism was set in motion, I had the pleasure of listening to the strains of old-world melodies as sweet as the notes of little tinkling bells.

I entered Turongo through the hallway connecting it with the assembly house of Mahinarangi. Here King Koroki has his private quarters, including a dining-room and modern kitchen of imposing proportions. The polished table of heart of oak seats 24, and the matching chairs are upholstered in dark red leather. The deep window seats, similarly cushioned, and the white curtains of fine net, and the black-patterned ponga vases on the small occasional tables carried out the colour scheme of the tuhi (scroll work) on the rafters. The enormous fireplace with its magnificently-carved overmantel was flanked by two specially-made kava bowls, and an entire corner of the room was enclosed semi-circular fashion from floor to ceiling by three tiers of doors of diamond-leaded glass. This unusual cupboard served as an ideal repository for the precious crystal and china with which Turongo is so plentifully endowed.



Hallway of Turongo House.



The dining-room of King Koroki's house.

The sitting-room was also in the form of a half-circle, being roofed by a curved tower. The room was fragrant with the perfume of lavender drying in a Ming-shaped container of Carlton ware in that glorious shade of red known as rouge royale, and featuring a delicate sylvan design of butterflies and trees in burnished gold overprint and coloured enamels. Instead of holding floral decorations, the wall-vases above the silvery-beige and peacock-blue tapestry suite displayed a selection of toroa plumes worn in warfare by the King fighters when short of huia feathers.

The outer hall door with its leadlight panel bearing King Koroki's coat of arms opened on to the sheltered verandah fronting Turongo, an excellent vantage spot from which to view at close range the carvings composing the exterior of the house. Even the wooden posts of the verandah were ornamented in this way, and the concrete foundations had been beautified in accordance with the notably high artistic standards of the Maori by being inset with paua shells brought at Princess Te Puea's behest from the beach at Marokopa. Picture the lovely iridescence of these opal-hued shells when the sun shines on them, each one a miniature rainbow in itself. It was very pleasant to linger in the King's courtyard where waratah bloomed redly and a row of young manukas clipped to symmetrical perfection marched down the lawn to the muted music of water flowing from a stone fountain, and look my fill upon the whare whakairo, the carved houses of Turongo and Mahinarangi, which are Waikato's pride and glory.

Mary

lovely dream

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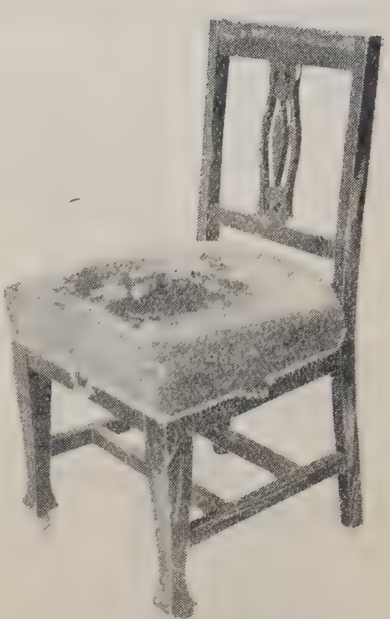
TRANSFORMATION TRICK WITH AN OLD CHAIR

By EVA TOPPING, *Rural Sociologist, Auckland.*

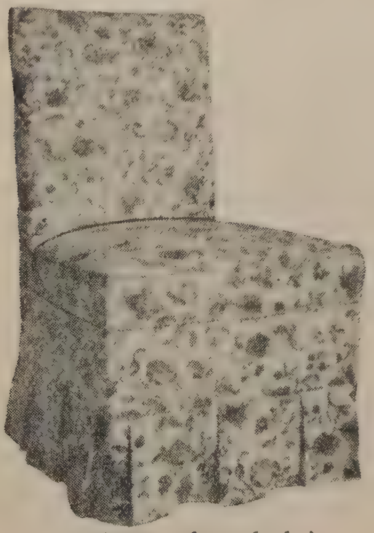
THE "before" photograph of the old chair really makes it appear better looking than it was, for the seat covering had faded; time and moths had eaten away some of the pile; and the woodwork was very scratched and shabby. The back must have been even higher once, because the top bar was unstained, with tack-holes where a padded piece had been attached, and the corners were rough and showed saw marks. In fact, though the seat was comfortable and well sprung and the frame sturdy, sound, and quite free from borer, the chair was no ornament in any room and the back was too upright for comfort. A conversion job was planned, and in case you have one of these old timers and would like to turn it into an up-to-date fireside or bedroom chair, here is the way it was done.



The old chair.

FIRST, the chair was taken into the open air and thoroughly but lightly beaten to remove dust from the seat. Then the castors were removed; this was a little difficult as they were well rusted, but when a little kerosene was used around the screws they finally yielded. Of course, when the castors were taken off, the back legs were longer than the front, and the next step appeared to be to cut off a piece from each back leg. However, as the chair seat would still be too high off the ground, it was decided to shorten the front legs first. Taking bits off the legs of tables and chairs can be troublesome, as each leg must be exactly right or the piece of furniture will wobble. If your chair is too high, stand it on a table and measure **up** from the table top, marking the position on each leg where the cut is to be made; a block of wood, a tin, or anything with a firm edge and of the correct depth will do for a gauge. This method is much safer than measuring from the top down.

When the two front legs had been shortened, the back ones were cut a little lower than the front to give a slightly-backward tilt to the chair. These cuts were made at an angle so that the base of the legs would be level when the chair was standing. To determine the correct slope for the cuts, the chair was placed side down on the floor, with the base of the front legs on an edge of a floor board. The board was used as a guide to scratch a mark on the edge of the back leg and the cut was made parallel with the floor board. When all the legs were cut and the chair was standing quite steady, one big hazard had been safely negotiated.



The transformed chair.

Altering the Back

Cut a piece of thin wood to fit in the back frame behind the rails, leaving a gap about 3in. between the base of the chair back and the seat. Preferably, this sheet of wood should be three-ply, but the lid or side of a box or other thin wood could be used. Fix it in place with long, slender tacks or very fine, short nails. Avoid using heavy nails, for they may split the frame. The padding, which varies according to the shape of the chair being converted, is the next step, and for this flax tow is useful, if it is procurable in your district. It can be used to make the under-part of the stuffing, but cotton waste which is sold for cushion filling should be used for the outer layer to give a smooth, soft surface.

On the chair illustrated a little extra padding was needed just above the seat and along the top rail to make the back more comfortable and to give a better line. To obtain this effect a piece of cloth was tacked on to the lower rail at the back and drawn through to the front. It was then tightly padded with cushion filling, the same process being repeated at the top.

Padding the Back

Next, a piece of material was cut to the shape of the back, generous turnings, about 3in. top and bottom and 2in. on the sides, being left. Do not skimp these turnings, as the back covering should be in one piece and must go well round the frame at every point. It was tacked firmly in place on the bottom at the back, and pulled through to the front. The side edge was turned under and tacked down at the back, half-way up one side. Then the padding was begun by pushing the filling well down, making it firm

The legs shortened and the back padded.

TRANSFORMING AN OLD CHAIR . . .

The back covering well round the frame at every point.

and free from lumps. The first side was tacked securely and the second side **lightly** as the work proceeded up the back, and the material was carried over the first padding and fastened securely along the top. The second side was pulled firm and tacked down carefully. The turnings were all made double to give a firm, tidy edge and to prevent the material tearing.

At this stage one can begin to see what the finished chair will look like and can decide the type of new covering it is to have. It can be a tight cover tacked on back and seat only, or a loose slip as shown in the illustration. Heavier materials should be used if the covering is to be tacked directly on to the chair; loose covers can be of lighter-weight fabrics, and cretonne, linen, cotton tapestry, casement cloths, chintz, printed cottons, and gingham make good washable slips.

Making the Loose Cover

Measure the chair and calculate the amount of material required. If you are using a patterned fabric which has a decided repeat design, be sure to allow for cutting the backs and seat pieces so that the motifs come in the centre of the area. When a flounce is attached, whether pleated or gathered on, remember that the length of material required for the flounce is **at least** one and a half times the measurement round the chair at the point where the flounce joins the cover.

Cut patterns in paper for:

1. The shape of the seat top, leaving ample turnings at the sides and front and about 5in. to tuck down on the back edge;
2. The front of chair back, allowing sufficient width to cover the sides and top and 5in. to tuck in between back and seat;
3. The back from top of chair to top edge of flounce;
4. The front panel; and
5. The side panel (the side pieces will probably narrow from front to back, especially if the tilt of the chair has been altered by lowering the back legs).

Lay the patterns on the material, remembering to cut two side panels. Cut lengths for the flounce, leaving sufficient for turnings at the head and a ¼in. hem at the foot.

Take up the seat section and pin it firmly in position on the chair on the wrong side of material, leaving good turnings on the front and sides. Lay a piping cord on the edge of the seat and pin a turning over it; tack carefully in position and stitch by machine close to the cord.

Join the front and side panels, and pin them on to the chair right-side out. Put the seat piece on the chair and pin it in position over the front and side panels, making a lapped seam. Stitch again close to cord.

Take the front back section and pin it on chair back. Make mitred corners at the top so that the material covers the top and sides of the back. Stitch these two corners. Stitch the seam at junction of the seat and back portions, leaving both ends free.

Put the cover on the chair **wrong-side out** and pin it in place. Tuck the extra material well down at the back.

Take up the long back piece and pin it across the top and down the sides, pulling it tight across the back so that the cover fits well. Measure from the bottom of the shaped side panel to the point where the top of the flounce will come, and cut pieces to fit the front and sides.

Remove the cover and stitch down one side and across the top at the back.

Lay a piping cord round the sides and the front of the panel, and stitch. Attach the second front and sides. Join lengths of materials for the flounce and make the hem. Gather or tack pleats, as preferred.

Replace the cover on the chair and pin the flounce in position, making sure that it is quite even and just clears the floor. It will be easier if the chair is set on a table to do this part.

Stitch on the flounce.

Finishing Back

Make a hem down the open edge at the back and a facing on the front part. This opening can be finished with hooks and eyes or dome fasteners if preferred, but stitching it on the chair by hand is more satisfactory, as the cover can be adjusted smoothly over the back and has no gaps, which is often the case when fasteners are used. Tuck the "pocket" down well between back and seat, and make a roll of newspaper, pushing it well down in the "pocket" to keep the seat cover from working loose in wear. If four small glides are fixed to the legs, the chair will move easily.

The materials used for the illustrated chair were: :

	s.	d.
2½ yards cretonne at 4s. 9d. a yard	11	10½
1lb. cushion filling	1	3
Set of small glides ..		6
Piece of three-ply wood		
Old cretonne cushion cover (strong but very faded).		

The old chair was bought second-hand for 7s., bringing the total **outlay** to a little over £1.

The length of material and amount of stuffing necessary may vary for a differently-shaped chair, but the variation would be very slight.

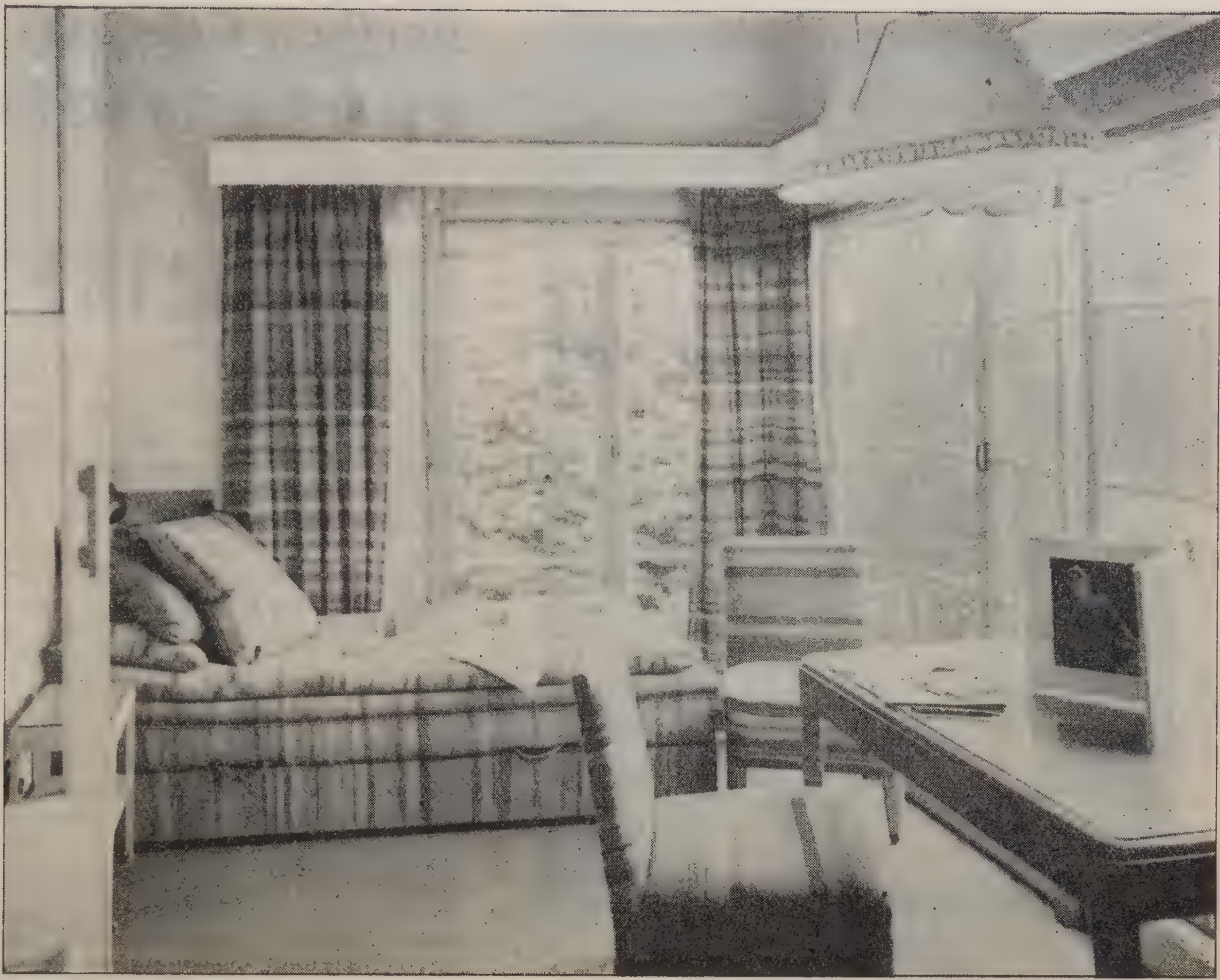
[Photographs by Sparrow Industrial Pictures Ltd.

Grey-Winged Days

DON'T you love the "grey-winged days"? We have so many of them here in the south—grey skies with patches of ethereal blue-green over the horizon, the sea calm and cold and colourless, but full of reflections. It seems to me that on such a day there is a little hushing finger raised so that even the breeze walks on tiptoe, and the tiny waves are almost afraid to clap their hands. They do it so softly you have to stand very still, right at the water's edge, to hear them. Do you know these lovely lines of Helena Henderson's?:—

I love these soft, still, pearl and opal days.
The sun, like a shy lover, hides his face,
Yet all his ardour filters through the haze
Like glow-worm light in a grey shadowy place.
The trees stand breathless. No exalting wind
Goes singing through them loosening from their hold
The spent, sad leaves that autumn-long have pined
To dance a dervish-dance in showers of gold.
There are so many days that fill my heart,
Bronze days and blue days, and the days of Spring;
But a soft grey day is a thing apart,
The filmy bloom upon a linnet's wing.
There may be in the calendars of Heaven
One pearl and opal day in every seven.

—**"Tinkle Tinkle," Dunedin.**



[Sparrow Industrial Pictures Ltd.

WAYS WITH WINDOWS

By NORMA K. METSON, *Rural Sociologist, Wellington.*

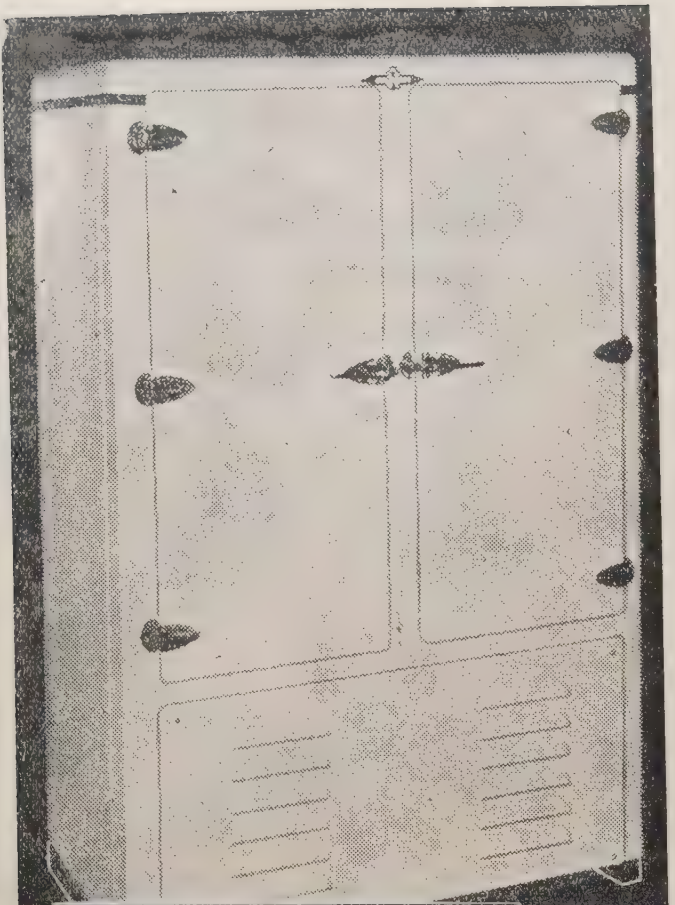
WINDOWS are put in walls to provide rooms with air, light, and sunshine, and so that those who live in the house may look out on the world beyond. All these functions would be admirably fulfilled by plain windows, yet windows always have curtains. Why? Is it merely fashion and convention? I think not. Even the best-proportioned window, framing the loveliest view, looks naked without the softening influence of some surrounding fabric, and many windows have faults—bad proportions or placing, ugly woodwork, depressing outlook, or light too glaring—which can be corrected or minimised by skilful curtaining.

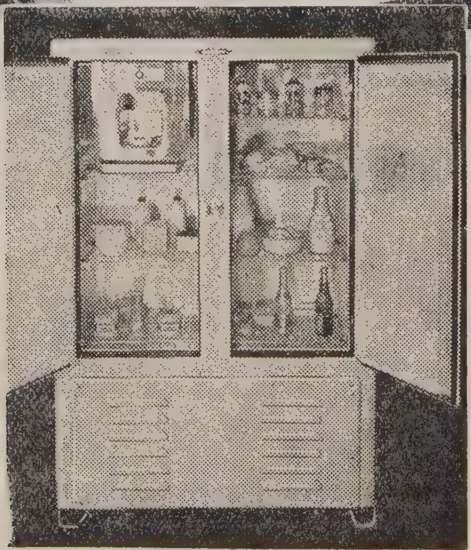
WELL-CHOSEN curtains add to the attractiveness of good windows and help to disguise bad ones. They can be made part of the room background, of a colour and texture which blend inconspicuously with the walls, or used as one of the chief decorative features. In either case they are a connecting link between the room and outdoors.

Materials are still scarce and expensive, so in curtains as in many other things simplicity and utility are the order of the day. In any case curtains should never be so ornate or otherwise unsuitable that they interfere with the normal use of the window.

If the children like their windows wide open day and night in all weathers, have short, sturdy curtains tied back so that they will not blow about. If you have a lovely view, or need to watch the children as they play outside, do not obscure the outlook with glass curtains.

There are two types of curtains—glass curtains, and draperies or hangings. Glass curtains, made of light, sheer materials, are used to soften the light from the window and to give privacy; they are usually hung just to touch the window sill. Draperies or side curtains are usually of heavier material hung to make a frame for a window or group of windows. They are frequently made full length and wide enough to pull across the windows so that no blinds are needed. A bay window might have long draperies framing the opening and sill-length glass curtains at the windows, but except in formal rooms it is not necessary to have both types.





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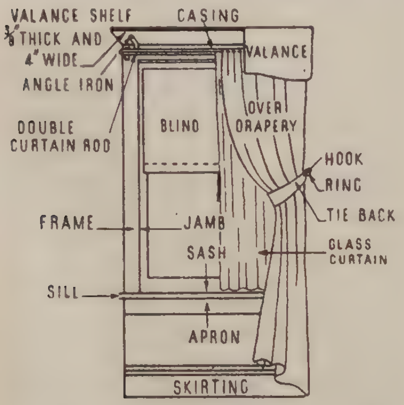
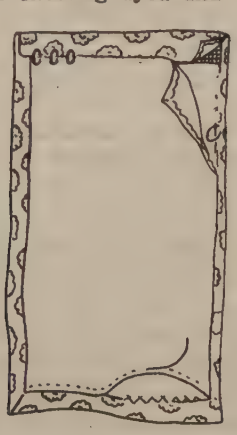
Choice of Materials

The choice of materials will depend on several factors, principally the amount of money which can be spent, the range of fabrics available, and the type of room for which they are to be used. The colour and texture of the curtains should harmonise with the rest of the furnishings, and the amount of pattern already in the room will determine whether a plain or a patterned fabric will be most suitable. Almost any type of material can be used for curtains if it will hang in graceful folds and the weave is firm enough to prevent them stretching out of shape. Light, ruffled curtains are suitable for dainty bedrooms; sturdier materials are better in family living-rooms.

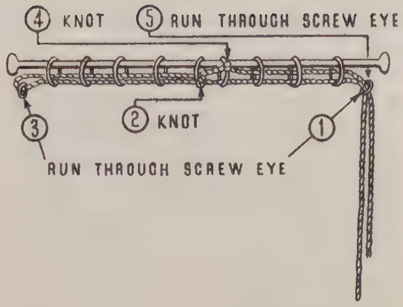


Window and curtains with sections named.

Silks, satins, brocades, and velvets go with polished furniture; linens, cottons, and novelty weaves look better in informal rooms. Ginghams, chintzes and cretonnes, cottage weaves, and crease-resisting rayons are very popular and suitable for the average home. Inexpensive curtains can be made from cheese cloth, unbleached calico, or sheeting dyed and trimmed with broad bands of colour, bindings, or appliqué designs. Flour bags can be used in the same way.



How to line a curtain. Note stiffening across the top.



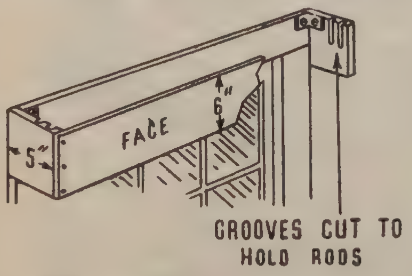
Method of making pull cords for curtains. Thread cord following the numbers in order.

Light-weight prints and similar fabrics can be used for draperies and pull-across curtains if they are lined with sateen, for example. Lining is also good for protecting more expensive curtains, as it prevents the sun's rays from fading and rotting the main fabric, and curtains which have been lined also hang more gracefully.

Samples of curtains which will not be lined should always be hung at a window to see the effect of light shining through. Pre-shrunk and colour-fast materials are preferable, and all washable materials should be shrunk before being made up, or allowance for shrinking left in the length.

Care in Measurement

Very careful measurement is essential for successful curtains. All the windows should be measured separately, as there are often small differences in the sizes of windows which look alike. A yard ruler or carpenter's rule should be used; an inch tape is not accurate enough. Sketch the window and frame, and enter the measurements on the diagram. The finished length of the curtain (the distance from the rod to the sill, bottom of apron, or floor) should be measured first, and allowances added for hems and shrinkage. In a large patterned material further allowance must be made for matching the pattern in each pair of curtains.



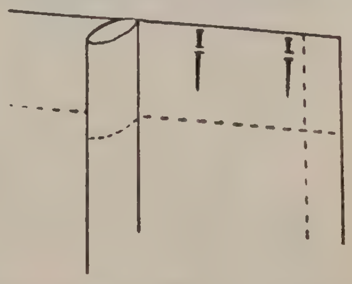
Construction of a wooden cornice.

Double hems are best for top and bottom, and if they are made the same width, the curtains can be reversed for longer wear. The curtains will hang better if the selvedges are cut off and a narrow hem or some other finish applied to the sides. If both glass curtains and draperies are to hang from the same rod, turn both hems together at the top; otherwise a double rod must be used.

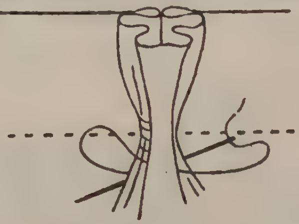
Hems to hold curtain rods should be made wide enough for the rod to slip through easily. The use of a rod is the simplest way to hang curtains, and the rod may be either of light, rigid wood or metal, or an expanding metal one. For more formal draperies, or for draw curtains, metal rings, hooks, or pulleys are sewn to the curtains and threaded on the rod.

A curtain which is to hang straight should be made at least twice the width of the space it is intended to occupy. That allows it to hang in graceful folds, which will not appear if the material is too narrow. The positions of the folds may be regulated by adjusting the fullness along the rod at the top of the curtain, or French pleats may be sewn in as shown in

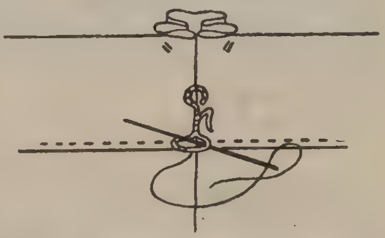
METHOD OF MAKING FRENCH PLEATS IN TOP OF CURTAIN.



Step 1—Mark off and fold material.



Step 2—Press fold down into three pleats and catch down.



Step 3—Sew fastener on pleat.

the diagram. Draw curtains must be wide enough to cover the whole window, and a little extra fullness should be allowed as well, so that there will be no dragged look when they are pulled across.

Inconspicuous "Fixings"

It should always be a rule to make the "fixings" of the curtains as inconspicuous as possible. Ornate curtain poles and brackets are seldom beautiful, and if any portion of the rod shows, it should be painted the same colour as the woodwork or wallpaper behind it. Valances, pelmets, or painted wooden cornices are an attractive finish across the top of a window, and they are very useful in making a unified whole out of a group of windows; for example two tall, old-fashioned windows on the same wall can be brought together by a cornice joining them. These fittings are quite simple to make, and can also be used to add height or width to a window which is badly proportioned.

Though the interior appearance of the curtains is more important, consideration should also be given to how they will look from outside. Houses are usually planned so that there is some degree of symmetry and uniformity in the size and placing of windows, and it is a pity to spoil this by too violent contrasts in the types of curtains used. It is preferable, too, that blinds should all be the one colour.

Types of Windows

The commonest types of windows in New Zealand homes are old-fashioned sash windows, casement windows which open outward (these may have a fanlight above which opens separately), and Whitney windows of the sliding type.

The old-fashioned windows cause difficulty because of the large amounts of material needed to curtain them, and in some rooms a single window of this type looks too high and narrow. If glass curtains are required, material can be saved by covering only the lower half of the window. A single over-draping may be used, instead of one at each side, if it is spread across the rod to cover the whole width of the window at the top and looped back to one side lower down. Draped curtains of this type look better if the material is shaped a little, so experiment with an old sheet until it hangs satisfactorily, and use it as a pattern when cutting.

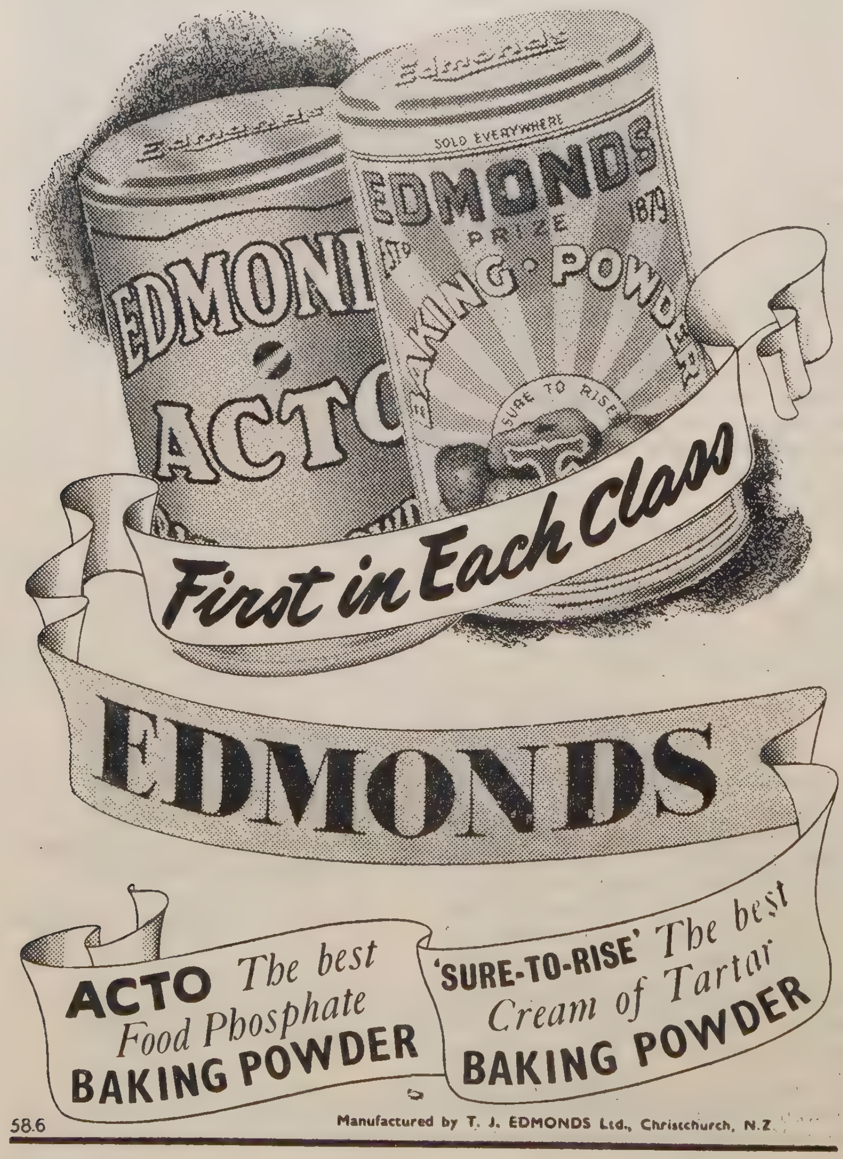
The high, narrow appearance may be disguised in several ways. By screwing an extra piece of wood to the top of the window at each side the rod can be extended and the curtains hung so they cover only the wall and window frame, instead of frame and glass as is usual. A deep valance or pelmet, especially if it is darker in colour than the draperies, will decrease the apparent height of the window, and so will draperies with horizontal bands or stripes.

Casement windows are usually grouped but have fairly wide wooden divisions, so if the upper portion is leadlight, and blinds are used too, the amount of light entering is relatively small for the window area. Glass curtains for such windows should be light and sheer, draperies and valances, if used, should make a frame for the whole group of windows, and curtains should be arranged so that they do not interfere with the opening of the windows. Painting the woodwork white or cream will make the room much lighter.

Windows which can be pushed along to leave the whole space open are most usually found in sunporches and bedrooms. As the aim is to obtain a maximum amount of fresh air and sunlight, curtains should be only at the sides of the windows, or, better still, made so that they too can be pushed back out of the way or drawn forward if required to eliminate glare or give privacy.

For kitchen, bathroom, and laundry, where curtains are sometimes in the way, windows can be finished by this novel method: Tack a light wooden frame of the desired width over the window frame and decorate it with enamel, or paste on American cloth, or wallpaper with a coat of shellac. Do not be afraid to try out new ideas like this. Make curtains and windows do what you want them to, rather than try to have them look like something out of a Hollywood stage set.

Photograph in heading by Sparrow Industrial Pictures Ltd.



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The Flower Garden in February

THIS is the time of year when the efficient gardener has time to enjoy the fruits of earlier labours. Planning has been at fault if the garden is not a blaze of colour in February. A gardener who is disappointed with the display of flowers at this season should look around neighbours' gardens and public parks, make a written note of the plants which are now in full bloom in other people's borders, and make a mental resolution to have as good a show next year. These notes by the Horticulture Division will help the gardener to plan well ahead.

ANEMONE corms should be planted as soon as they are available. Commercial anemone growers avoid planting the largest sizes of corms, preferring the so-called "pea" sizes.

Annuals sown now should winter well outdoors in most districts and make an early display next summer. Nigella (love-in-a-mist), Shirley poppy, larkspur, and calendulas are all quite hardy and will succeed if dealt with in that way, provided that in the coldest districts plants do not become too large before the winter sets in.

Chrysanthemums grown for show require careful attention to stopping and disbudding, but for garden display less detailed attention is necessary. Disbudding to produce one large bloom on each stem reduces the period during which a plant is in flower, as there are no more buds to open when the main flower has faded. The finest mass effect is obtained by leaving all the buds on, especially with the single varieties, which look attractive as "sprays"—not disbudded.

Dahlias required for show should be disbudded, removing all flower buds except the largest one as soon as they can be handled. Dressings of lawn mowings around the plants help to keep the soil moist, and applications of dilute liquid manure help to produce really large blooms.

Everlasting flowers, such as helichrysums, acrocliniums, and rhodanthes should be cut when in full flower with as long stems as possible, tied into bunches, and hung upside down in a cool shed to dry. When the flower stalks have hardened the flowers should be put away in boxes, out of the light and dust, until required. By treating them in this way the stems dry straight and the flowers are of more value for use in vases.

Geranium and Pelargonium cuttings will root easily at any time in the summer or autumn. Ensure a supply of these showy plants by rooting plenty of cuttings. It is fashionable to sneer at geraniums, but few plants give a longer or brighter display of flowers, especially if the summer is dry.

Hedges should now be pruned for the last time this season by removing as little as necessary of this year's growth. Coniferous plants must not be cut back into last year's growth, as most of them cannot produce new shoots from old wood, and shoots which are cut too hard die, leaving an unsightly place in the tree. The popular *Cupressus Lawsoniana* cannot be regarded as a wholly satisfactory hedge plant for the garden because individual seedling plants vary greatly in their vigour. If an attempt is made to keep the hedge uniform and symmetrical, some plants are inevitably cut harder than others, ultimately leading to the death of the more vigorous plants and an unsightly gap in the hedge.

Hoeing regularly between herbaceous plants, shrubs, and roses, wherever the hoe can reach, will prevent some weed seeds from germinating or kill young weed seedlings before they have time to do much harm. Many gardeners have a push hoe with a specially small blade which can be used for keeping the soil loose between plants in the borders.

[*Photo News Ltd.*

The scarlet Scarborough lily (*Vallota purpurea*), shown above, and the Belladonna lily (*Amaryllis belladonna*), which is similar but has pink flowers, are useful in the garden, as they flower in February and March, a time when showy flowers are needed. The plant flowers well in pots in the house, and also makes a gord border plant in places where severe frosts are not experienced. The bulbs should not be more than half buried in soil, and, once established, should not be moved or re-potted more often than every four or five years.

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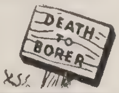

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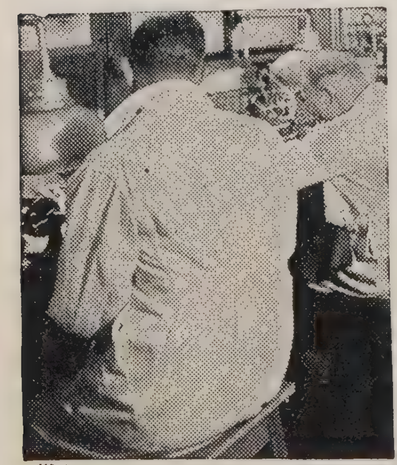

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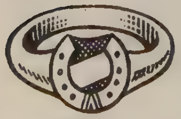

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A Message to Parents and Children:

The slogan for every parent should be "P.C." which means *Please Co-operate* to *Prevent Caries* in children's teeth. This is of course another way of saying "prevent decay".

The School Dental Service provides regular dental attention for children, instructs them in home care of the teeth, and gives advice on tooth building and tooth cleansing diets.

Complete co-operation is therefore necessary between parent, child and school dental nurse. To gain the maximum benefit parents are urged to help by ensuring that advice given at the school dental clinic is followed up at home.

P.C. also stands for *Pre-school Child.* Children from the age of two and a half years should receive regular dental inspections either from a dental surgeon or, should roll numbers permit, at a school dental clinic.

Keep this announcement
for future reference

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THE FLOWER GARDEN IN FEBRUARY . . .

[Photo News Ltd.

Bulbs are easy to grow indoors to provide a cheerful display of blooms in the winter months. They can be grown in bowls, when bulb fibre should be used instead of soil. For bulbs in plant pots, a wad of rough leafy material (see heap on the right) should be put in the bottom of the pot, and covered with a thick layer of good garden soil. The bulbs should then be put in place and more soil packed firmly round them so that the soil comes to within ½in. of the top of the pot, and the noses of the bulbs are just covered.

Hydrangea cuttings taken now, rooted in a frame, and later potted into 3 or 4in. pots, should flower in these pots next summer and make useful, decorative house plants. Pot hydrangeas which have finished flowering in the house should now be pruned by cutting the dead flower heads off with a few inches of stem, and should then be stood outside in a sunny position to make strong, ripe, new shoots which will flower next year.

Narcissi of the poeticus types have little, if any, resting period in the summer. Plants of these varieties which have been lifted should be replanted as soon as practicable. It is a curious fact that many of the latest-flowering narcissi need the earliest planting.

Rambler roses can be propagated readily from cuttings, which are best made from short laterals which have flowered by pulling them from the old stem with a heel, taking off the lower leaves and flower head, and inserting them firmly in soil.

Prune rambler roses when the flowers have faded by cutting back to ground level all growths which have flowered. The new shoots which have grown from the base this year should then be tied in to flower next summer. This system does **not** apply to climbing roses, which do not produce new shoots freely from the base, and which are pruned in spring by cutting back side shoots to within an inch or two of the main stems.

Seedlings of biennials, such as sweet Williams, Canterbury bells, and wallflowers, sown last month, should now be large enough to be handled. They will not be required for planting out until later, when there is room in the flower borders, but if left in the seedling rows they will become drawn and spindly and develop a deep tap-root system which will be mutilated when the plants are lifted. The seedlings should be lifted and planted into a nursery bed, 3in. apart, as soon as they can be handled. They will then grow into sturdy plants with a bushy root system, which will transplant well. If the soil is dry, both the nursery bed and the rows of seedlings should be thoroughly soaked with water the day before the seedlings are to be planted out.

Sweet pea seeds for early flowering should now be sown, ½in. deep and 3in. apart, in soil which has been deeply dug and enriched with a dressing of compost and superphosphate. A few extra seeds should be sown at one end of the row to produce spare seedlings for transplanting later into any gaps which may occur. To ensure that the seeds germinate without delay, each seed should be rubbed once or twice across a sheet of sandpaper or nicked with a knife. The injury to the seed coat enables the seed to take up water more readily from the soil.

Violas are best propagated by cutting down plants which have flowered to induce them to form plenty of new shoots from the centres of the plants. When 2 to 3in. long the new shoots should be carefully detached, with or without a small heel, and dibbled out in a frame which should be kept moist and shaded until the cuttings have rooted.

Bulbs, such as freesias, hyacinths, and the early paper white narcissi, should be potted up now and stood outside in a cool, shady place, preferably with the pots sunk in the soil to their rims and covered with a 3in. layer of sand or old ashes to keep the pots moist. Leave the pots in that position for about 6 weeks, during which time the bulbs will root well, and then take the pots indoors.

Weeds are the flower gardener's chief enemy. They are unsightly, make the garden and borders look untidy, crowd out growing plants, especially young ones, make a great deal of work, and, by far the most important indictment, they take large volumes of moisture from the soil in direct competition with the garden plants. This is especially undesirable in the hot, dry weather of this time of the year, as there is often little enough water in the soil to support proper growth. Fortunately weeds are easily killed in hot, dry weather, but if many common weeds are cut off while in flower, their seeds will still ripen and scatter after the plant has been cut. Large weeds cut while in flower should not be left lying on the ground but are best collected and burned or put in a properly-made compost heap to ensure that the seeds are killed. "One year's seeding means seven years' weeding."

Reminders About Common Troubles

Subterranean grass caterpillars are greyish-black caterpillars up to 3in. long when fully grown. They live in burrows which look rather like worm holes and make casts of soil which are sometimes confused with worm casts, though the soil of which they are composed is mixed with a silky material not present in true worm casts. The caterpillars feed at night on the grass, which is eaten off close to the surface. A badly-affected lawn may be practically bare, dotted with many holes the diameter of a lead pencil, in which the caterpillars hide during the day. A careful watch should be kept on lawns from January onward, and at the first signs that caterpillars are present a poison bait should be sown to control the pest before it has time to cause serious damage. Sufficient bait for treating 200 sq. yd. of lawn is made by mixing 1½lb. of bran (or similar material) with 1oz. of Paris green, and then moistening the mixture with 1½ pints of water in which ¼ pint of molasses has been dissolved. The bait, which should be moist but not sloppy, should be spread evenly over the lawn surface. Paris green is a highly poisonous arsenical compound, and every precaution should be taken when using it.

★

STALE BREAD USED IN

Left: Crumb fudge cake.

Below: Crisp cheese biscuits.

USES FOR STALE BREAD

By EVA TOPPING, *Rural Sociologist, Auckland.*

EVEN in the most careful household stale bread sometimes accumulates — odd ends of loaves which are really too hard for the table, a slice of bread not eaten at lunch, a piece of toast left from breakfast, or extra bread taken at a holiday weekend for expected visitors who did not arrive. With ever-present thoughts of bread rationing in Britain and the thousands of people in Europe who cannot get enough bread for their needs, nobody likes to discard these odd pieces. Not one crumb need be wasted, for there are many ways of making use of stale bread.

ONE easy time-saving way of dealing with crusty pieces of bread is to bake them slowly in a cooling oven until they are dry and crisp. Some of the pieces can be cut into fingers or squares before being baked and served as crunch; others should be cut into small dice for sippets with soup. If not needed at once both crunch and sippets will keep for some time if stored in an airtight tin or jar.

All the rough-shaped pieces, crusts, and slices of toast can be baked and then crushed to fine crumbs with a rolling pin. Stored in a tin or jar with a well-fitting lid they will keep perfectly, and are on hand for frying rissoles, croquettes, fish, chops, cutlets, and sausages; for sprinkling over savoury dishes like cauliflower or macaroni cheese, tomato and onion pie, and shepherd's pie; or for use in baked or steamed puddings and savoury biscuits. For steamed puddings, moisten the dry crumbs with hot milk or water and substitute half crumbs and half flour for the usual quantity of flour required.

Toasted Crumb Recipes

Here are some recipes which use the toasted crumbs:—

Fruit Betty

Put layers of sweetened, prepared fruit in a piedish, alternating with layers of crumbs. Make the last layer of crumbs, sprinkled with sugar and dotted with butter. Bake until the fruit is tender and the top crusty and golden brown. Soft fruits such as blackberries, raspberries, currants, soft ripe pears, and grapes can be used raw, but gooseberries, plums, rhubarb, and the harder fruits need to be partly stewed before being baked.

Crumb Fudge Cake

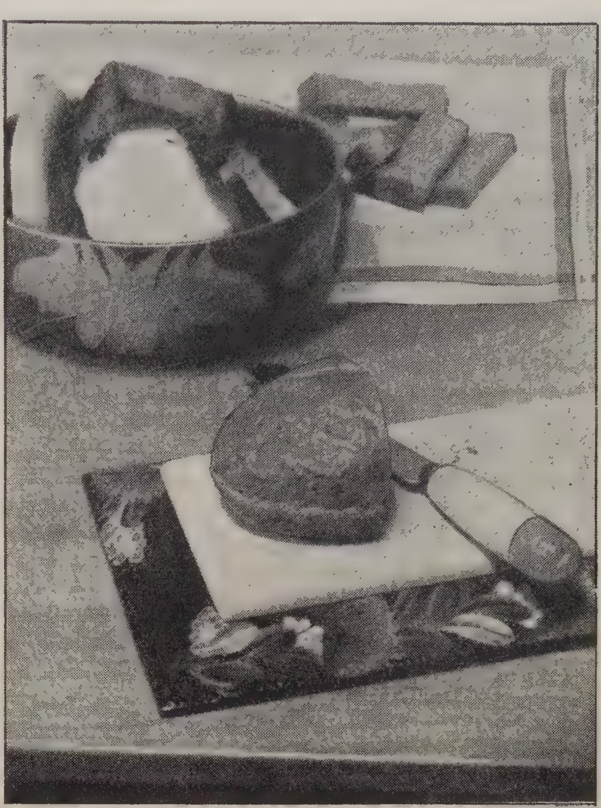
2 tablespoons syrup or honey
2oz. butter
flavouring (vanilla, almond peppermint, or orange)
2oz. cocoa
2oz. sugar
6oz. dried crumbs (not too fine)

Put syrup, butter, sugar, and cocoa into a saucepan and heat until melted. Stir in flavouring and breadcrumbs, mixing thoroughly. Spread evenly in a well-greased tin and press flat with the back of a spoon. Mark into fingers and leave to set for at least 24 hours. Keeping for two or three days improves the flavour.

Crisp Cheese Biscuits

2oz. butter or mild dripping
2oz. grated cheese
½ cup flour
½ cup dried breadcrumbs
¼ teaspoon cayenne pepper
½ teaspoon salt
small teacup water

Rub fat into flour, add cheese, breadcrumbs, salt, and pepper, and mix to stiff paste with water. Roll very thin, cut into shapes, and bake in a moderate oven.



Steamed Apple or Pear Pudding

¼lb. breadcrumbs
1lb. pears or apples
1oz. dates (optional)
Sugar to taste
2oz. suet

Grease a pudding basin and coat it with some of the breadcrumbs. Mix the rest of the crumbs with the finely-chopped suet. Pare or core the fruit and mix with chopped dates. Put one-third of the breadcrumbs and suet into the basin, then half the fruit, another layer of breadcrumbs, then fruit again, finishing with the remaining breadcrumbs and suet mixture. Cover the pudding with a greased paper and steam it for 2 hours. Turn it out on a hot dish and serve with custard or sweet sauce.

Apple Pie with Cinnamon and Crumb Crust

Fill an ovenware dish with stewed apples. Take 1 cup breadcrumbs, ½ cup sugar, ¼ cup butter, lard, or mild dripping, and 1 teaspoon ground cinnamon. Cream the fat and sugar, and add breadcrumbs and spice. Spread the mixture over the apples and bake until the crust is slightly browned.

Bread in Puddings

The crumb parts of stale bread can be used for puddings and stuffings. Bread pudding appears on most family tables now and then, but it need not always be the same kind of bread pudding, for their are ways of varying the theme. Choose one from the following recipes, some of which may be new to the family.

Summer Pudding

Rinse out a pudding basin with cold water and line it neatly with slices of crumb bread cut to fit so that no basin shows through the lining. Stew enough fruit to fill the basin, sweeten to taste, and pour it into the basin while still hot, reserving a little of the juice. Cut a round of bread to make a lid, set it in place, and pour over it the rest of the juice. Cover with a flat plate and put a weight on top. Leave in a cool place until next day and serve cold with custard, top milk, or junket. The stewed fruit should be fairly firm and the slices of bread thick or the pudding will collapse when turned out of the basin.

Syrup or Honey Bread Pudding

8 to 10 slices of stale bread
3 tablespoons honey or syrup
2 tablespoons butter
1½ tablespoons sugar
2 eggs
1 pint milk
pinch salt

Remove the crusts, cut the bread into small cubes, and put it into a greased piedish. Beat the eggs and stir in the honey or syrup. Melt the butter and heat half the milk. Pour the hot milk over the bread cubes. Put the melted butter and the remainder of the milk into the liquid mixture, pour it over the soaked bread, and bake in a moderate oven for about 1 hour. Do not let the custard boil, and do not use too much bread or the pudding will be stodgy.

Bread Pudding with Variations

2 cups stale breadcrumbs
1 quart milk
½ cup sugar
¼ cup melted butter
raisins, sultanas, or currants
2 eggs
¼ teaspoon mixed spice or 1 teaspoon vanilla

Heat the milk and pour it over the breadcrumbs, cool, and stir in sugar, butter, flavouring, and slightly-beaten eggs. Pour into a greased fireproof dish and bake in a gentle oven for about 1 hour.

Chocolate: Omit the fruit and spice and add 2 tablespoons or more of cocoa and vanilla flavouring.

Queen's: Omit the fruit. Beat 1 egg white very stiff and fold in 1 tablespoon sugar. Spread top of pudding with jam or jelly and cover with the meringue before baking. The extra yolk can be used in the pudding.

Coco-nut: Omit fruit and spice and add ¼ to ½ cup of desiccated coco-nut to the bread before soaking it.

Savoury Stuffings

Savoury stuffings of all kinds need stale bread as a basis. Enclose them in joints, poultry, rabbits, or fish, bake or fry them as forcemeat balls, or cook and serve them separately in an ovenware dish.

Sage and Onion Stuffing

(For ducks, pork, colonial goose, etc.)

1lb. onions
8 sage leaves
salt and pepper
2 large tablespoons stale breadcrumbs

Peel the onions, boil them for about 10 minutes, strain, and chop finely. Add the sage (previously dried in a slow oven or on a rack and powdered between the fingers), breadcrumbs, salt, and pepper. The onions are usually moist enough to bind the mixture, but some of the onion water can be added if the stuffiing is too dry and crumbly.

Egg-and-bread sauce with bacon.

Forcemeat

(For fowl, turkey, rabbit, veal, or fish.)

2oz. suet or melted dripping
¼ teaspoon thyme or mixed herbs
1 teaspoon chopped parsley
4oz. breadcrumbs
grated rind of ½ lemon
1 egg
milk
salt and pepper

Mix all the dry ingredients and bind with lightly-beaten egg, adding a little milk if necessary. Use as stuffing, or form into small balls and fry or bake.

For filling marrow or pumpkin use either the forcemeat or the sage and onion recipe and add skinned sausages, minced meat, chopped bacon or ham.

Parsley Stuffing

¼lb. beef suet or dripping
1 dessertspoon chopped parsley
1 breakfast cup breadcrumbs
1 egg
salt and pepper

Chop the suet and parsley, mix with crumbs, salt and pepper. Bind with the beaten egg, adding a little stock or milk if necessary to give a soft consistency.

Stuffing using Soaked Stale Bread

8oz. stale bread (crusts included)
1 onion or leek
1 stick celery
1oz. dripping or suet
4 tablespoons chopped parsley
2 teaspoons mixed herbs
1 egg
salt and pepper

Soak the crusts in water until soft, squeeze them dry, and place in a basin. Beat well with a fork to remove lumps. Mix with finely-chopped onion and celery, add suet or dripping (melted), parsley, herbs, salt and pepper, and finally the egg.

Breakfast Dishes

Egg-and-bread Sauce with Bacon

Put a slice of stale bread about 1½in. thick into a basin, pour over it 1 cup of hot milk, cover with a plate or saucer, and leave to soak for a few minutes. Beat it up with a fork, add salt and pepper and 1 egg, and beat again. Fry bacon, remove from pan and keep hot. Turn the egg and bread mixture into the frying pan and cook, stirring constantly for a few minutes until the egg is set. If the bread is very dry more milk should be added before cooking.

Eggs in Bread Nest

Take enough stale bread to fill a piedish, and pour hot milk over to soak it. Beat with a fork, add chopped parsley, thyme, salt, and pepper. Spread in a well-greased piedish and make depressions in the bread by lightly pressing in the bottom of a cup or back of a spoon. Break the required number of eggs, one into each depression, season, cover the top with dried breadcrumbs, and dot with butter, dripping, or bacon fat. Bake until the eggs are set.

Photographs, with the exception of that on page 105, by Sparrow Industrial Pictures Ltd.

First Aid Treatment of Wounds

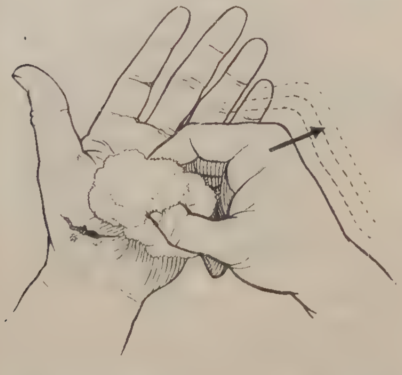
CLEANSING, dressing, bandaging, and the general principles in the treatment of all wounds are discussed in this article, the fifth in a series on first aid by C. Meachen, secretary of the St. John Ambulance Association, Wellington.

IF bleeding from a wound is severe, the patient must be placed in a lying position with the bleeding part elevated, unless a bone has been fractured or a foreign body is in the wound. Immediately stop the bleeding by applying direct pressure over the wound with a clean, firm pad, or indirectly by applying pressure to the bleeding blood-vessel with a ligature or tourniquet. Pressure must not be applied directly to a wound where there is a fracture or a foreign body; in such cases bleeding must be arrested by the indirect method.

Remove foreign bodies unless they are deeply embedded in the wound, in which case make the part immovable and cover the wound lightly when applying dressings. Protect the wound against infection by making sure that hands and objects used in treating wounds are clean and sterile. Dressings used must also be clean.

Cleaning of Wounds

Dirty wounds must be made as clean as possible by washing them with water that has been boiled. Always wash away from the wound to avoid rubbing dirt into it. The wound may also be cleaned with a piece of cotton wool soaked with hydrogen peroxide, weak tincture of iodine, or other antiseptic. Wounds may be treated with any of the following antiseptics:—

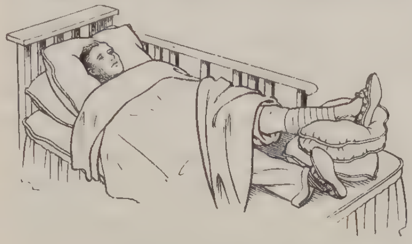


Hydrogen Peroxide: A good general antiseptic.

Potassium Permanganate (Condy's crystals): Used in weak solution this is a good general antiseptic, especially suitable for wounds near the bone—on the shin, for example.

Melasol: A good general antiseptic, used in a solution of a quarter teaspoonful to 1 pint of sterile water, hot or cold. It is most suitable for wounds in which there is danger of infection.

Tincture of Iodine: A good antiseptic for deep and punctured wounds when penetration is desired and when bruising accompanies the wound, but its use should be avoided if possible when the wound is over or near a bone.



In cases of severe bleeding elevate the bleeding part.

Boracic Acid Solution: Half to one teaspoonful in 1 pint of sterile water can be used as a general antiseptic, but dry boracic acid powder should never be used on wounds, because it destroys tissue and may cause the wound to become septic.

Saline Solution: A teaspoonful of salt to 1 pint of sterile water is especially useful for cleansing purposes.

Ointments, Plaster, and Lotion

Never use ointments in the first-aid treatment of a wound. They make the surrounding tissue soft, may enclose dirt in the wound, and make the wound difficult to clean when fresh dressings are required.

Never apply adhesive plaster directly to a wound. It also makes the edges of the wound and the surrounding tissue soft, and when being removed is likely to tear the wound open again. If plaster must be used in the dressing of wounds, always place a piece of plain lint or clean material over the wound first, and apply the plaster over the top of it.

If the use of a lotion seems advisable, dressings of "L" healing lotion may be applied, but if there is the least possibility of foreign matter or other causes of infection being enclosed in a wound, it should be kept open until it is properly cleaned, or until it heals naturally.

"L" healing lotion consists of 2 parts by volume of Friar's balsam to 1 part each of castor oil and olive oil.

After a wound has been cleaned and antiseptic has been applied, cover it with a clean dressing. Place a clean piece of plain lint, woolly side out, or other material next to the wound, cover this with cotton wool, and then apply the bandage. If possible, avoid putting cotton wool directly on the wound, as it is very difficult and painful to remove when fresh dressings are required.

If the extent and nature of the wound make it necessary, support and rest the injured part with a bandage, arm sling, or splint.

Keep the patient warm and give treatment for shock. If there is danger of haemorrhage, do not give stimulants. If the wound is large, if there has been a great loss of blood, or if the patient's condition otherwise requires it, make arrangements for hospital or medical treatment as soon as possible.

London Spica Bandage

A method of tying a bandage which will prevent it from slipping over the sides of the hand is known as the London spica bandage.

Make a simple spica on the finger or thumb. Take the bandage up and across the back of the hand, round the wrist, and down and across the back of the hand to the finger or thumb. Repeat this two or three times. When the wrist has been reached after the required number of spirals has been made, split the bandage about 10in. from the underside of the wrist, tie a knot, take both ends of the bandage round to the top of the wrist, and tie them again. Then draw each loose end under the bandage, crossing on the back of the hand, and tie them on the back of the hand.

The Triangular Bandage

A piece of material at least 40in. square is required to make a triangular bandage. The square can be folded diagonally or cut so that it makes two bandages. It can be used for almost any purpose for which a bandage is required—

1. To cover and hold dressings in place;
2. To hold splints;
3. To maintain pressure on blood-vessels to prevent bleeding;
4. To act as a constricting band to control venous bleeding;
5. To act as a ligature to prevent poison from circulating toward the heart;
6. To act as arm slings or support for other injured parts.

Surgical Dressings

Dry dressings are used to cover wounds after they have been treated with an antiseptic lotion. They exclude the air from the parts, protect against infection, and protect and soothe damaged tissue. They may consist of plain absorbent lint, surgical gauze, any clean plain material which has been boiled, or, in cases of emergency, handkerchief, and clean parts of plain clothing.

FIRST AID TREATMENT OF WOUNDS . . .

Cold packs are used to lessen and control haemorrhage in the tissues and organs and to prevent swelling at injured joints. They should consist of 4 or more folds of material soaked in iced or at least cold water. Suitable materials are plain absorbent lint, flannel, several folds of lighter materials, or cotton wool when it has not to be placed over wounds.

Hot fomentations are used to draw foreign matter from septic parts, to reduce swelling, to ease pain, to reduce inflammation, and to assist Nature in an effort to rid the system of impurities from septic wounds and boils. A hot fomentation consists of 4 or more folds of material wrung out of hot water with the aid of forceps or by being placed inside a clean towel, the ends of which are twisted in opposite directions until most of the water has been wrung out. If it is applied too moist or too hot, the patient may be scalded. If hot fomentations have to be applied over a wound the material used should be clean, sterile, and either of the plain or boracic acid lint. The water should be boiled and, if plain lint is used, an antiseptic such as melasol can be added to the water. Flannel, or cotton wool placed between the folds of clean plain cloth, are other suitable materials.

Bread poultices are sometimes used to draw foreign matter and pus from infected parts, to reduce inflammation, and to soften skin tissue so that boils or abscesses can erupt freely. **They must be used only on unbroken surfaces.** To make a bread poultice take a quantity of soft bread and place it in a clean piece of cloth or lint; put this in a container and sprinkle a little boracic powder over the bread. Pour boiling water over the bread and, when it is soaked, lift the piece of material containing the bread out of the container, fold the material over, and wring out as much water as possible. When the poultice is cool enough, place it directly against the skin, cover it with cotton wool and bandage just firmly enough to hold the poultice in position without squeezing the bread out from under the bandage.

* * *

The following question was received recently:—

"Should a boil be poulticed?"

A boil is caused by certain microbes getting in the skin, where they multiply until a superficial abscess is produced. The application of poultices of linseed meal, bread, bran, potato, or any other unsuitable substance produces the degree of moist heat that favours microbic growth. In a day or two the boil develops a nasty appearance. Infective matter from the boil spreads over the patient's body and to articles in the house.

It cannot be too strongly stressed that untrained people should leave all septic conditions alone, for their well-meant interference only makes matters worse. A nurse or doctor should be asked to deal with these complaints. A boil is not a trifling matter; on the contrary, it can have serious consequences. Once a house or a person's clothing becomes infected there is no limit to the harm that may follow.

* * *

Readers are invited to forward questions on any problems dealing with first aid or home nursing. Questions should be forwarded to P.O. Box 25, Te Aro, Wellington, E.2.

BATH CLEANER

Readers may like to try this bath cleaner. Mix 1 teaspoon of cream of tartar with sufficient hydrogen peroxide to make a paste. Rub this over the bath and leave on for a while. Remove with a soft cloth.—**"Me Too," Clevedon.**

For his Lordship THE BABY

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Enables baby plenty of room to play in complete safety. The "RELAX" Play-pen is a marvel of ingenuity—it can be folded completely flat for travelling. The small illustration shows the pen folded pyramid-fashion to make a very effective clothes drier.

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HYDRANGEAS

HYDRANGEAS must be given pride of place among flowering shrubs in all except the coldest districts of New Zealand. There are few other garden shrubs which will flower for so long each year, make such a bright display, flower as such young bushes, succeed in such diverse situations, or have so few diseases and pests. Hydrangeas are easy to grow, but some points often overlooked are mentioned in this article by J. P. Hudson, Horticulturist, Wellington.

HYDRANGEAS have been cultivated for centuries in Japan and China, and improved garden forms are said to have been introduced to Kew, England, from Japan in 1790, long before the natural wild species was discovered, through a Dutch firm which was permitted to maintain a trading firm at Nagasaki.

The plant has since earned great popularity both as a pot plant for indoor decoration and as a garden shrub in districts which are not subject to severe frosts in winter. It has found great favour in New Zealand, especially in the coastal regions, where it grows with the greatest luxuriance. Unfortunately many gardeners have planted the common white varieties, which have rather a funereal look. Many of the newer varieties are far brighter and more desirable, providing welcome and unusual colour displays for long periods each year.

Soil and Situation

One of the main reasons why hydrangeas have become so popular is that they can be grown in a very wide range of soils and situations, though they do better in some than in others. A rich, well-drained, loamy soil which does not dry out produces the largest bushes and finest blooms. A constant supply of moisture at the roots is necessary if growth is to continue unchecked through the season. Hydrangeas growing in light, sandy soil suffer in dry weather unless special attention is given to watering and mulching. On the other hand, soils which lie very wet in winter are not suitable, as the roots are injured if the soil is waterlogged for any length of time.

The hydrangea is hardier than is commonly supposed, and will grow outside in all but the coldest places in the Dominion. Hard frosts may cause the shoots to die back, leading to loss of the buds which should have flowered in the following season, but it is unusual for bushes to be killed outright by frost unless the ground freezes hard.

The hydrangea is accommodating in its choice of situation, growing in full sun or heavy shade, but it probably comes nearest perfection in partial shade. It will also stand wind better than many broad-leaved deciduous shrubs, but does best where it is sheltered to some extent from bitterly cold winds in winter and hot, searing winds in summer.

Hydrangeas will do quite well in shaded corners, between houses, and in other closed-in places where little else will grow, though the best flowers are not usually produced in such situations. That is chiefly because corners overshadowed by buildings often receive much less than their full allotment of rainfall, and are apt to dry out completely in summer. Timely soaking with water and liquid manure will do much to help plants growing in odd corners and passages.

Fertilisers and Mulch

Each bush should be given an annual spring topdressing of 2 or 3 handfuls of blood and bone, scattered on the surface round the plant to cover a circle of soil about the same diameter as the bush. The surface of the soil should then be lightly pricked over with a fork, taking care not to injure the roots, many of which lie near the surface.

In the early summer the surface of the soil around the bushes should be mulched with a layer of well-rotted animal manure, compost, or leaves to conserve the moisture in the earth and prevent the sun's rays from beating directly on the surface of the soil. The mulch also reduces the risk of the soil cracking, which may lead to the roots being seriously injured.

In high summer an occasional topdressing of complete fertiliser thoroughly watered in, or generous applications of liquid manure, will help to keep the bushes growing strongly and ensure healthy new shoots as well as a long succession of flowers during the season. Liquid manure can be made by half filling a sack with animal manure and suspending it in a tub of water. The liquid, which soon becomes dark brown, should be diluted with water to the colour of tea before it is watered on to the soil around the plants.

Rainfall and Watering

Rainfall is not evenly distributed on the soil of a shrubbery. The arrangement of the leaves is such that rain drips from leaf to leaf and often tends to fall more on one spot than another. A high proportion of the rain may be diverted to one area while other places remain relatively dry, even after heavy rain. Moreover, the total rainfall absorbed by the soil in a shrubbery is less than in open ground, as much of the rain, especially when it falls in showers, remains on the leaves and branches to dry off when the weather clears without reaching the ground at all.

These points should be borne in mind where hydrangeas are growing in the shelter of hedges and near

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[There is much confusion about the nomenclature of the common garden hydrangea which should be known as *Hydrangea macrophylla* Thunb, but is usually listed as *H. hortensis* Smith, *H. hortensia* Sieb, or *H. opuloides* C. Koch.]

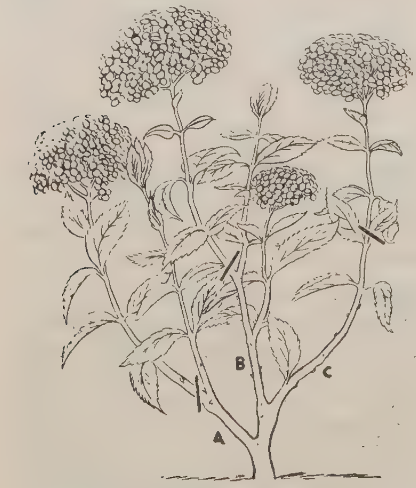
houses, as it may often be found that the soil under the bushes is bone dry though it may be quite moist in other parts of the garden. The condition of the soil near the bushes should occasionally be investigated with a trowel to see whether it is quite moist to a depth of 9 or 10in. If not, a thorough soaking with water will put new life into the plants.

Summer Pruning

Few flowering shrubs will withstand neglect as well as hydrangeas, which will flower regularly and profusely without being pruned at all, which is not surprising as pruning, in any case, is an unnatural operation. Under this system, or lack of system, however, the bushes become larger, the flower stalks shorter and more bent, and the bush more leggy. At the other extreme, bushes are sometimes slaughtered annually as though they were bush roses, yet somehow recover and flower, though unduly late in the season.

The most desirable type of hydrangea is a neat, well-clothed bush, covered throughout the summer and autumn with large trusses of flowers borne on strong, straight stems suitable for cutting. This habit is the result of careful and intelligent pruning.

Each hydrangea branch bears a series of leaves arranged in opposite pairs. One bud is produced where each leaf joins the stem (axillary buds), and an additional bud develops at the tip of each shoot (terminal buds). The buds are of two kinds, flower buds and wood buds. The flower buds are larger and rounder than wood buds, although this distinction is not always clear, as there is a considerable gradation of size. The bud at the tip of each branch is usually a flower bud, as is one or more of the buds produced in the leaf axils nearest the tip of each branch. The remainder of the buds placed lower on the stem are all wood buds.



Pruning hydrangeas. Where a strong new shoot comes away from near the base of the bush, as at A, the flowering shoot should be cut back to near the new shoot as soon as the flowers fade. Branches such as B should be cut back to the lowest new shoot. Where there is no new shoot on a branch, as in C, the branch should be shortened by removing the flower head and three or four leaves.

When the buds grow in spring, each flower bud develops into a short leafy shoot at the end of which is a truss of flowers. The wood buds develop into leafy shoots which normally grow into long branches which do not flower that season, but on which the next year's flower buds develop in the autumn.

Thus any pruning done in the winter will inevitably reduce the following season's flowers, as the tip flower bud will, in every case, be removed when a shoot is cut off, and the axillary flower buds will also be removed if more than a few inches is cut off the end of any shoot. The best treatment where pruning is necessary is therefore to cut back the bushes in the summer to allow time after pruning for flower buds to develop on the shoots which remain.

Immediately the main batch of flowers is over, in late summer, each bush should be carefully examined. First, any weakly shoots should be cut out altogether. Next, if there are plenty of strong new shoots several feet long coming away from the base of the bush or the main branches, all the shoots which have flowered should be cut out altogether, preferably to the base of the bush or to the lowest strong new shoot. If, on the other hand, there are few new shoots, some or all of those which have flowered should be retained, but each should be shortened by removing the flower head and three or four leaves. The new shoots should not be thinned or shortened unless they are unusually numerous.

Old bushes which have been neglected are not so easy to prune because any treatment is bound to reduce the show of blossom in the first year after pruning. The best plan is to cut the branches hard back in the middle of summer, sacrificing some of the current blooms, but allowing time for new shoots to grow and form flower buds which will produce blooms next year.

Other Pruning Systems

A system sometimes practised is to prune in winter by cutting every shoot back to leave the lowest two flower buds on each. This preserves the shape of the bushes, but the loss of the terminal flower buds is a disadvantage, because the terminal and upper axillary flower buds usually produce the best trusses of flowers.

Another system which has its advocates in New Zealand, and has much to commend it, is to summer prune all new shoots by nipping out their centres when each is 6 to 12in. long. That ensures that the short new growths do not need to be pruned in winter and all the best flower buds, which develop toward the ends of the shortened shoots, are thus retained. Where necessary, growths which have flowered are cut right out in late summer when the flowers have faded, or are shortened back to the lowest new side shoot.

Cuttings Root Easily

Hydrangeas root readily from cuttings, which can be taken in the winter or, more usually, in the summer. Hardwood cuttings are taken in winter, 6 to 8in. long, trimmed off below a leaf, and inserted firmly 3in. deep in soil.

Soft-wood cuttings, which give better results, are made by taking off pieces with 2 or 3 pairs of leaves on each from the ends of new, non-flowering shoots in January, February, or March. Each cutting should be shortened to about 4in. by cutting it off cleanly just below a pair of leaves. The bottom pair of leaves should then be cut off close to the stem, and about half the leaf blade cut off each of the remaining leaves. It is important that the cuts be made cleanly, using a sharp knife or razor blade.

The cuttings should be inserted about 1in. deep in sandy, open soil in a cold frame, making sure that each cutting is firm, though pressure applied to the soil by the fingers should not be sufficient to bruise the soft stems. Water lightly with a watering can fitted with a rose, cover the cuttings with a single sheet of newspaper, and close the frame. Keep the cuttings moist by damping plants and soil regularly for a few days to prevent them from flagging, but as soon as they root the paper should be removed and the frame opened to give more air. When the cuttings are seen to be making new growth they should be removed from the frame and planted in a nursery bed until the autumn, when they can be planted out into their permanent places or left for another season to make better bushes before being planted.

Colour Manipulation

The colour of hydrangea flowers depends on a combination of factors, including the "true" colour of the variety concerned and the nature of the soil.

Unlike most plants, hydrangeas of a particular variety can vary violently in flower colour with the chemical composition of the soil in which the plant is grown. In soils which contain soluble aluminium compounds the petals of many hydrangea varieties are bright blue, but the same varieties have pink flowers when grown on soils containing abundant lime. Soluble iron salts cause some varieties to assume an unnatural dark green colour.

The best way of ensuring a good blue colour in varieties which are capable of turning blue is to dissolve alum or aluminium sulphate in water at the rate of 1 teaspoonful or 3oz. respectively to the gallon, allow the solution to stand for 12 hours, and then water the plants thoroughly with it. Iron sulphate, often recommended instead of alum or aluminium sulphate, is not as satisfactory for producing blue colours, but can produce mauve tones in some varieties, though it may also cause the flowers to assume an unpleasant greenish colour.

In some soils the liquid application may not be sufficient to ensure a good blue colour; the soil itself may absorb the aluminium before the hydrangea roots can take it up. In such cases a dressing of up to 10lb. of aluminium sulphate scattered round each bush as a topdressing **in winter** should ensure the desired colour. The use of such a heavy dressing in the growing season is not safe, because it might cause the leaves to turn yellow and even to fall prematurely.

To ensure good pink colours the soil should be dressed very liberally with lime before the bushes are planted and should be given an annual topdressing of lime at the rate of 4oz. to the square yard.

The natural white varieties will not take on any other colour, but remain white whatever treatment they may be given.

Choice of Varieties

With so many brightly-coloured, showy types of hydrangeas available, it is a pity to give garden space to the old, colourless white type, which adds nothing to the cheerfulness of the garden. Among the many good varieties available the following can be recommended:—

Parcival: The best of the rich, blood-red flowers with heavily-frilled petals.

Deutschland: Rosy-red, blues well.

Blue Prince: Rosy-red, but goes bright blue when treated.

Holstein: Deep blue when treated.

Carmen: Brilliant red dwarf.

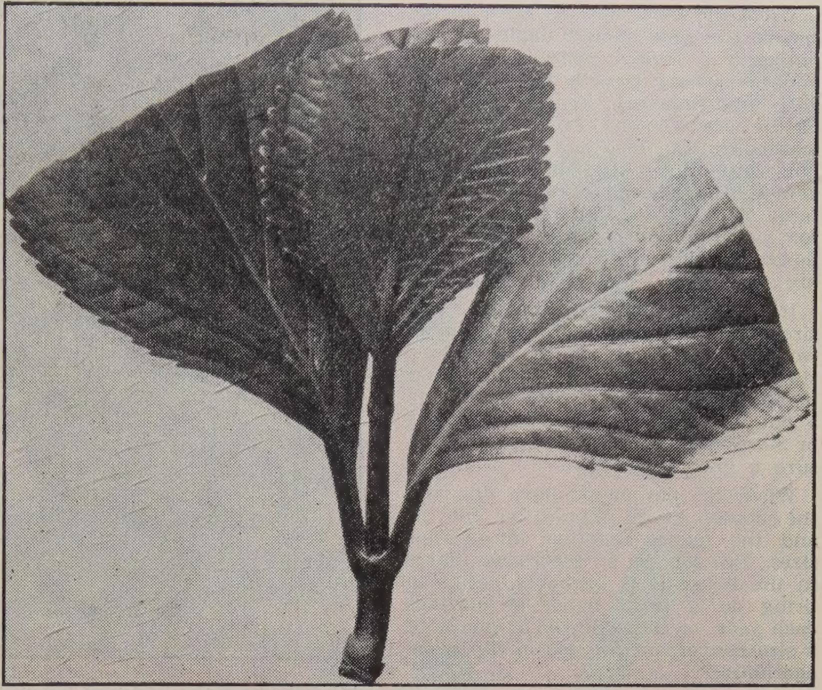
Marechal Foch: Rose-pink, blues well.

Sensation: Deep mauve, huge cup-shaped flower.

Niedersachsen: Large mauve-pink flowers.

Peer Gynt: Rich rose-red, with very large trusses of flowers.

TAKING HYDRANGEA CUTTINGS



Cutting of hydrangea taken from the end of a non-flowering shoot. The lowest pair of leaves has been removed and the remainder of the leaves reduced by cutting off part of the leaf blades.

Culture as Pot Plants

Hydrangeas make first-class pot plants which are easy to grow and very showy. The usual method of growing them in this way is to strike cuttings individually in 3in. pots, and later pot them on to flower the next year. Ensure that the soil in the pots is well drained by putting a piece of broken plant pot, convex side down, over the hole in the bottom of the pot. Cover this with a few smaller pieces of pot, and place a thin pad of moss or leaves over these to prevent soil from working down among the drainage and choking up the hole in the pot.

Fill the pots with a turfy compost to which plenty of decayed leaves or chopped moss has been added, press the soil down gently, and insert one cutting in the soil in each pot. The cuttings should consist of the ends of new shoots taken, as described earlier, when the first flowers are beginning to fade. The pots should be stood in a frame or a shaded place in the garden, watered carefully, and then covered with a sheet of newspaper to maintain a moist atmosphere around the cuttings and prevent them from wilting unduly. Damp the cuttings and pots every day if the weather is dry, and continue to give protection with the newspaper until the cuttings have rooted, as shown by the fresh green appearance of the leaves in the centres of the shoots.

When the cuttings are well rooted and growing strongly the pots should be put out where they get plenty of sunlight, though it is an advantage if they are stood under a tree which shades them from the full glare of the midday sun. At this stage the plants need watering frequently, except in wet weather, and the soil should never be allowed to dry out. It is worth while to sink the pots in ashes or soil up to their rims, which makes it easier to keep the soil moist.

When the roots of the young plants are filling the soil in the pots (which can be seen by carefully knocking a plant out of its pot and inspecting the ball of soil), pot them on into 5in. pots, again using a turfy compost. Damp the foliage once or twice a day for the next few days, but do not water until it is really necessary. Toward autumn the pots should be stood out in the full sun to make sure the plants are thoroughly ripened before the winter.

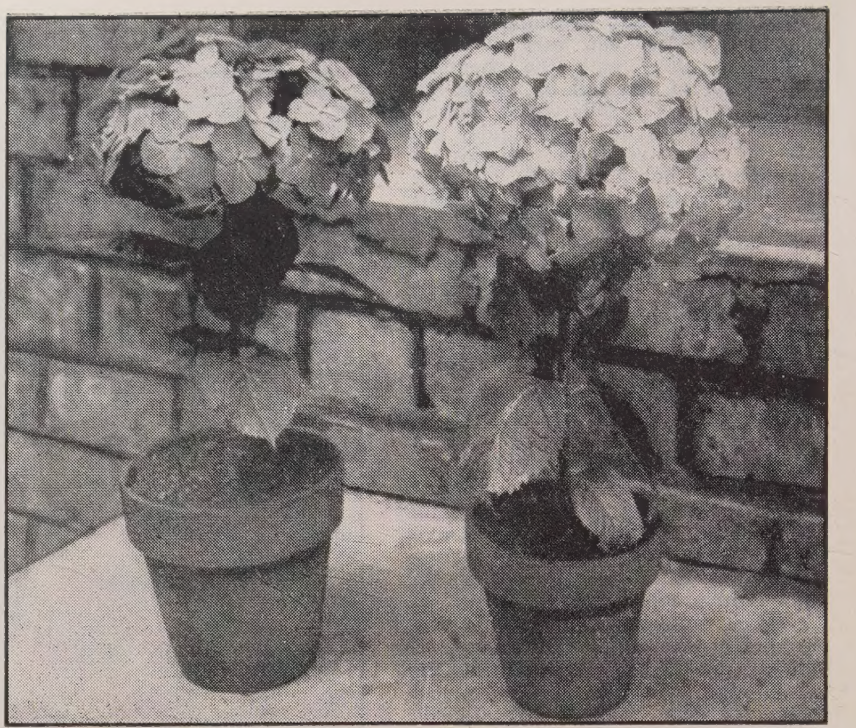
In winter, when the leaves are seen to discolour (or fall off in colder districts), it is an advantage to put the plants inside a light shed or under a hedge to avoid the pots being soaked by rain. Though hydrangeas should not be allowed to dry out completely in the winter, it is necessary to keep the soil in the pots only very slightly moist.

HYDRANGEAS . . .

When the buds start to grow in the spring the pots should again be put out into a sunny position, watered, and, as strong growth develops, fed with liquid manure. At the beginning of the season many gardeners add a teaspoonful of blood and bone to each pot, scratching it into the soil to prevent it from going mouldy on the surface. That dressing obviates the need for using liquid manure until the flower buds can be seen in the developing shoot.

If particular colour effects are desired, the colouring treatments detailed earlier may be applied to pot plants, starting when the flower buds can first be seen. Half a teaspoonful of alum to a pot, applied to the surface every 2 or 3 weeks and watered in, should ensure a good blue tone.

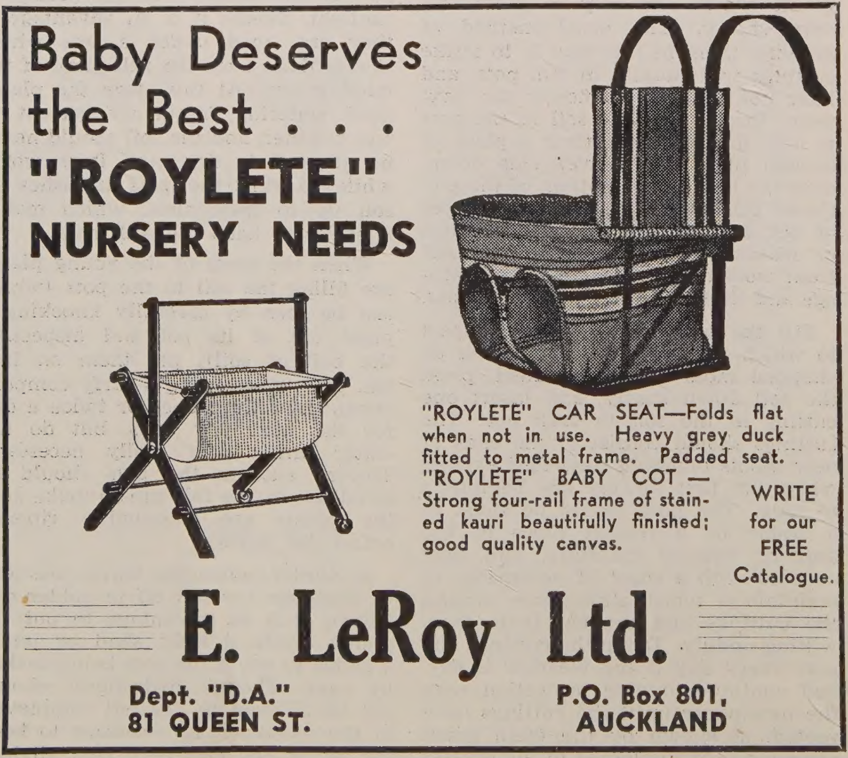
When the pot plants have flowered the flower heads should be cut off and the plants repotted into larger sizes. But for use as decorative plants in the house it is probably better to bring on a fresh batch of cuttings each year, as these flower as plants of a size convenient for use in the average house.



Hydrangeas make first-class pot plants. It is usual to strike cuttings individually in 3in. pots, and later pot them on to flower the next year.

Few Diseases or Pests

The hydrangea is remarkably free from diseases and pests in New Zealand—in fact, no diseases of hydrangeas are recorded at all, and the only pest recorded is the apple mealy bug, which attacks many fruit and ornamental bushes and trees. Mealy bugs can cause considerable damage by sucking the sap, but cause an added nuisance by secreting a sweet, sticky juice (honey-dew) on which black moulds develop, causing unsightly black blotches on the foliage. Mealy bugs can be controlled by spraying the trees with nicotine sulphate (2oz. of soap, dissolved in a little hot water and added, with 1 fluid oz. of nicotine sulphate, to 4 gallons of water), or by the use of summer spraying oil diluted to a strength of 1 part in 100 of water.



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HOLIDAY BOOK

WHAT A pleasant afternoon I have spent, thanks to "Lincoln", of Dannevirke. My small nephew usually spends his holidays on the farm with me and, being a city child, the beach and the animals are a constant delight to him. He loves to help feed the calves and see the cows being milked. Later on, perhaps, the novelty of these things will wear off, but Tim's "Holiday Book," which I have begun this afternoon, will keep these memories close, I hope. I have a full set of snapshots of him feeding the pet lamb, sailing his small boat, and even one of him with his very first fish—a sprat! I wonder what his thoughts will be in, say, 20 years' time, when he opens his "Holiday Book" and sees those photos and paragraphs I have pasted in for him. Perhaps, like the rest of us, he will think, "Those good old happy, carefree days."

Thank you, "Lincoln."

—"Ellen May," Kaipara.

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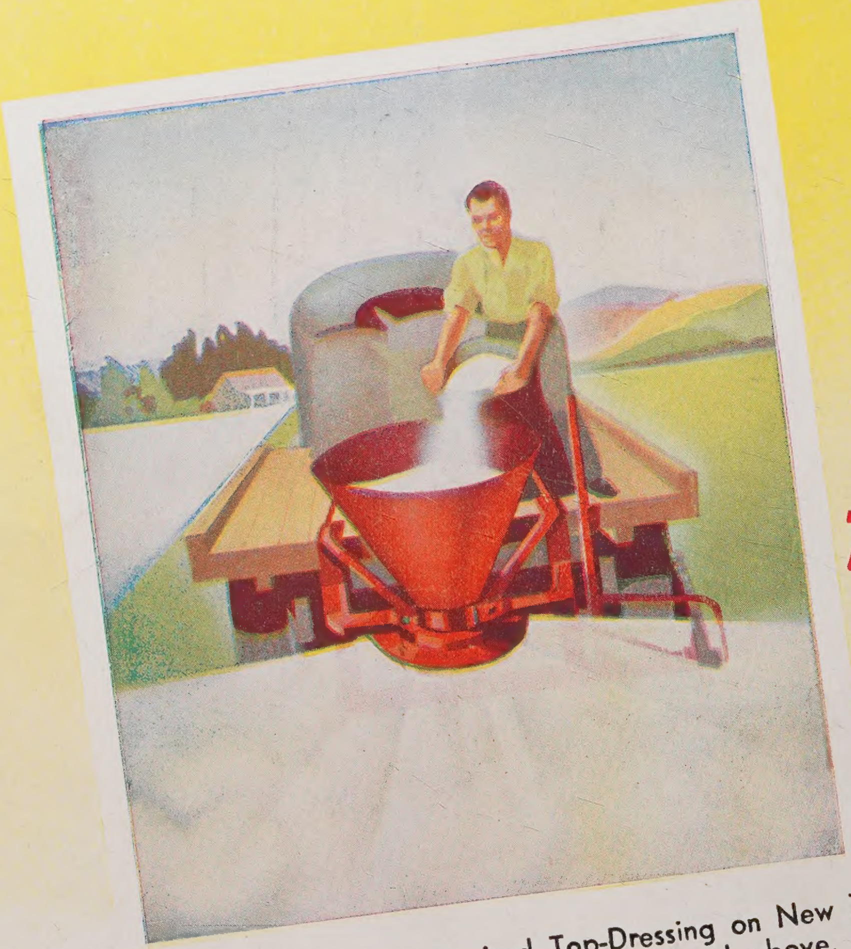

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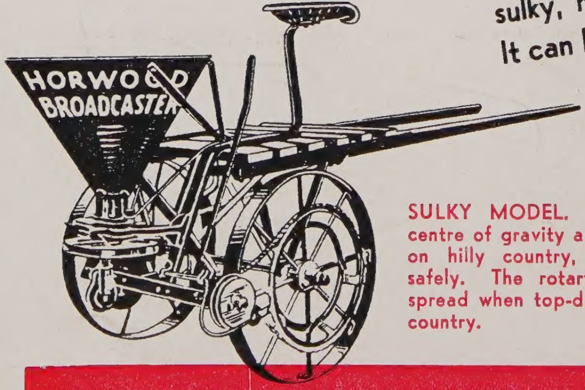
The Horwood is interchangeable and can be mounted on sulky, motor-truck, dray, konaki, or tractor-drawn trailer.

It can be driven through narrow gateways without uncoupling.



SULKY MODEL. 5½ft. wide, has a low centre of gravity and can therefore be used on hilly country, both satisfactorily and safely. The rotary action gives an even spread when top-dressing on hilly or broken country.

**LISTER
SEPARATOR
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HORWOOD *Rotary* TOPDRESSER